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Scientific Method Applied to Startup Funding

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Abstract

The following thesis is based on an experiment conducted by the Politecnico di Torino, the Politecnico di Milano and the ICRIOS Bocconi Center, called InnoVenture Lab, in which 154 startups (mainly innovative) that are in the early stages of development, took part, divided into two groups: a treatment group and a control group. Both were taught about financial planning methods and tools for raising capital for innovative businesses, however, as opposed to the control group, the treatment group was also introduced to the so-called "scientific method", which scholars claim it helps businesses making better management decisions. The objective of this work is to demonstrate that businesses choosing to apply this method increase their chances of obtaining fundings. This thesis, therefore, begins with a description of the Italian environment of innovative startups and their trends, moving on to a description of the main financing methods that are used in entrepreneurship, decision making approaches applied to entrepreneurship and the use of the scientific method. Then, it will be described the InnoVenture Lab project from which the data with which this work was carried out were obtained. It will then go on describing the experiment in detail, the sample of startups analysed, the results and the final conclusions.

Abstract in italiano

La seguente tesi si basa su un esperimento condotto dal Politecnico di Torino, dal Politecnico di Milano e dal Centro ICRIOS Bocconi, denominato InnoVenture Lab, al quale hanno partecipato 154 startup (prevalentemente innovative) che si trovano nelle prime fasi di sviluppo, divise in due gruppi: un gruppo di trattamento e un gruppo di controllo. A entrambi sono stati insegnati i metodi di pianificazione finanziaria e gli strumenti per la raccolta di capitali per le imprese innovative; tuttavia, a differenza del gruppo di controllo, il gruppo di trattamento è stato introdotto anche al cosiddetto "metodo scientifico", che secondo gli studiosi aiuta le imprese a prendere decisioni gestionali migliori. L'obiettivo di questo lavoro è dimostrare che le imprese che scelgono di applicare questo metodo aumentano le loro possibilità di ottenere finanziamenti. Questa tesi, quindi, inizia con una descrizione del contesto italiano delle startup innovative e delle loro tendenze, per poi passare a una descrizione dei principali metodi di finanziamento che vengono utilizzati nell'imprenditoria, degli approcci decisionali applicati all'imprenditoria e dell'uso del metodo scientifico. Verrà poi descritto il progetto InnoVenture Lab da cui sono stati ottenuti i dati con cui è stato svolto questo lavoro. Si passerà poi a descrivere nel dettaglio l'esperimento, il campione di startup analizzato, i risultati e le conclusioni finali.

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Introduction

In contemporary business and economic environment, the startup sector is recognized as a catalyst for innovation, creativity and economic expansion. Startups serve as an essential engine for the generation of novel ideas, technology and business models, frequently generating substantial repercussions for both society and the global economy. Nevertheless, the success of a startup is not assured and frequently relies on other elements, such as the availability of adequate funding and the capacity of entrepreneurs to make informed decisions.

The supply of financial resources is of paramount importance in facilitating the growth and expansion of startups. Hence, it is essential to comprehend the methods and strategies employed in securing and managing financing for startups in order to ensure the prosperity of these nascent businesses.

However, decision making in the startup world is frequently marked by substantial uncertainty and limited resources, requiring the adoption of rigorous, data-driven methodological approaches. Frequently, entrepreneurs tend to rely on heuristic or experience-based approaches, resulting in conclusions that are irrational or unsatisfactory. On the other hand, the utilization of the scientific method, which encompasses the development of theories, formulation of hypotheses, systematic collection of data, rigorous experimentation and analysis, may provide entrepreneurs with a distinct and unbiased framework for guiding their decision making processes.

In this paper, therefore, an attempt is made to answer the question of whether using the scientific method, thus a more scientific approach in decision making, can bring an advantage in raising capital.

This work was made possible thanks to the InnoVenture Lab project, which was organized by three prestigious Italian universities, Politecnico di Torino, Politecnico di Milano and ICRIOS Center of Bocconi University. This project involved 154 startups that were divided into two groups, the "treatment" group and the "control" group. Through the Randomised Controlled Trial methodology, they participated in a 4 lesson acceleration program, during which they were taught basic and fundamental concepts for developing a financial plan and raising funds. The treatment group was also taught to apply the scientific method in formulating their theories, which are necessary to make decisions consciously.

This thesis starts, therefore, by giving the definition of "startup" and "innovative startup", a definition found in the "Italian Startup Act"; this is followed by an overview of the Italian ecosystem, as the startups that took part in the project are part of this environment.

The following section discusses "entrepreneurial finance", which differs from "corporate finance" since startups are different types of companies from more mature ones and therefore, facing different challenges, need a different type of finance. Then the sources of finance that can be targeted by these ventures were discussed in detail.

Since the topic of this thesis is the application of the scientific method to decision making to obtain more funding, it was also necessary to deal with the most frequently used methods in decision making, thus the heuristic ones that are opposed to the scientific method. The application of the scientific method to management takes the name of "Management Science" and has been the subject of numerous studies.

Many scholars have already demonstrated several benefits that applying the scientific method to decision making brings to companies and startups, such as Ries showing that applying this method leads to reduced uncertainties and risk or Camuffo showing that startups applying this method have more successful startups as they pivot or abandon unprofitable projects early on, increasing their total success rate.

Afterwards, the theoretical framework of the research is presented, encompassing the study's objectives, research question and the corresponding hypotheses.

After that, the employed methodology is presented. The project involved the collection of several characteristics pertaining to startups, which were subsequently analysed to provide an overview of both the startups themselves and the investors involved in the project, mostly for descriptive purposes. Two research variables were created: "treatment_dummy" to indicate if the startup received treatment and "scientificity" to measure the level of scientific decision-making in the startup. In addition to the project, entrepreneurs were called subsequently to ask about their acquisition of funds during the post-training phase, with the intention of constructing a dummy variable denoted as "funding".

After the description of the econometric model used, data were, then, analysed. In addition to preliminary and descriptive analyses, empirical analyses were carried out, thus two multiple logistic regressions, where the independent study variables are "treatment_dummy" and "scientificity", while the common dependent one is "funding".

Following analysis of the data, conclusions were made, highlighting the research stream's weaknesses and potential for future advancements.

1. Literature review

In this part follows the literature regarding the main issues that the entire work is about.

1.1. Startup definition

A startup is a nascent enterprise that concentrates on creating a novel product, service or technology that responds to a specific market demand. Startups are frequently distinguished by their inventive and disruptive characteristics, as well as their rapid and adaptable business approach. However, in the initial phase, they usually achieve low revenue and frequently encounter negative cash flow.

Although there is no single definition for different industries and countries, some key characteristics present in most startups are as follows:

- Innovation: startups are known for their innovation and ability to solve existing problems. They use cutting-edge technologies and business models to disrupt existing markets;
- Scalability and high-growth potential: startups are designed to grow rapidly and scale their operations, paying back the entrepreneur and investors with high returns;
- Risk and uncertainty: startups are riskier ventures on average than mature companies. Several types of risk must be considered, such as that concerning the technology (whether it will work or not), whether one will be able to penetrate the market (already served by established players) and risks also related to the investment required. The high risk is offset by a potentially high return;
- Agility: startups, unlike large organizations, can be more dynamic companies, being more adaptable to the environment in which they are immersed and they can change their business plan easily depending on feedback from their customers;
- Passion: entrepreneurs, as well as employees, have a strong passion for their startup, product or service. They are often motivated by bringing improvement and positive impact to the world and this factor is a very important element of business success.

1.1.1. Most accepted startup definitions

Experts mainly focus on the diversity of the business a startup has compared to an established company and the time stage of development and growth, but not everyone agrees:

- The entrepreneur Neil Blumenthal focuses on the risk component associated with startups, defining it as “a company working to solve a problem where the solution is not obvious and success is not guaranteed”; (Blumenthal, 2014)
- Similar is the thinking of Eric Ries, entrepreneur and author of the best-selling "The Lean Startup", who argues: a startup is "a human institution designed to create something new under conditions of extreme uncertainty"; (Ries, 2011)
- Steve Blank argues that “a startup is a temporary organization designed to search for a repeatable and scalable business model”; (Blank, 2010)
- Paul Graham argues that "the only essential thing is growth. Everything else we associate with startups follows from growth"; (Graham, 2012)
- While there are those who think that age is not an important factor, such as the journalist Nastya Chernikova who thinks a startup is “not connected with time", since "they say that age it's not the number, but how it feels”. (Chernikova, 2014)

In general, the difference between a startup and a traditional business is obvious. There are several advantages, but also disadvantages, in working in a startup. Among the advantages there is definitely more responsibility and opportunities to learn, as there are fewer employees than in large companies, so employees and entrepreneurs can fill more roles and functions. Other advantages include more flexible hours, more interaction among employees and flexibility. Because innovation is always welcome, entrepreneurs also allow employees to put their ideas into play. The biggest disadvantage, on the other hand, is definitely the one related to risk: there is always the risk of running out of cash and going out of business, which can lead to stress, as well as wages that do not match the hours worked. Another disadvantage may be the high competition among different startups working on similar ideas.

1.1.2. Innovative startup definition

Since there is no real definition of "startup", what can be referred to is the definition of "innovative startup", for two reasons:

- Not all but most of the startups on which this study is based are registered in the "Registro Imprese delle Start-up innovative" (about three quarters);
- The concept of innovative startup is precisely defined by the "Italian Startup Act" (Italian Ministry of Economic Development, 2019) made available by the Ministry of Economic Development, in which the parameters for considering a company an innovative startup are defined, as well as describing what alternative methods of financing and tax relief these companies have, at each stage of their development. The ISA addresses the term "innovative startup" to new companies with strong nexus to technological innovation. No other limits are set, so innovative startups can operate in any business sector.

To be considered as such, however, there are legal constraints that must be met, expressed in Art. 25 of Decree-Law no. 179/2012, paragraph 2. These companies are defined as limited companies (including cooperatives), not listed, which must comply with the following requirements (Italian Ministry of Economic Development, 2019):

- They are newly established or have been incorporated for less than 5 years;
- They have their headquarters in Italy or in another EU/EEA Member State provided that they have a production facility or a branch in Italy;
- They have an annual turnover lower than €5 million;
- They do not distribute their profits and have not done so in the past;
- Their mission statement concerns, predominantly or exclusively, the development, production and commercialization of innovative products or services with a clear technological component;
- They are not the result of a company merger or split-up or of a business or branch transfer;
- Finally, they meet at least one of the three following innovation-related indicators:
    - Research and development expenditure corresponds to at least 15% of the higher value between turnover and annual costs (as per the last statement of accounts);

- The total workforce includes at least 1/3 of PhDs, PhD students or researchers, or at least 2/3 of the team hold a master's degree;
- The company is the owner or licensee of a registered patent (or it has filed an application for an industrial property right) or it owns an original registered software.

1.1.3. Italian Innovative startups environment

Below are some charts constructed from the database made available by MISE (Ministero delle Imprede e del Made in Italy, 2023), going to reconstruct how the innovative startup scenario has changed in the last years, following the issuing of the Start Up Act.

Figure 1 shows the number of innovative startups, new corporations present in Italy and their ratio. It is evident that the number of innovative startups is strongly growing, with an increase from 8920 to 13820, with the maximum reached in 2022 equal to 14708, while also the ratio of innovative startups to new corporations is increasing, from 2.65% to 3.60%.

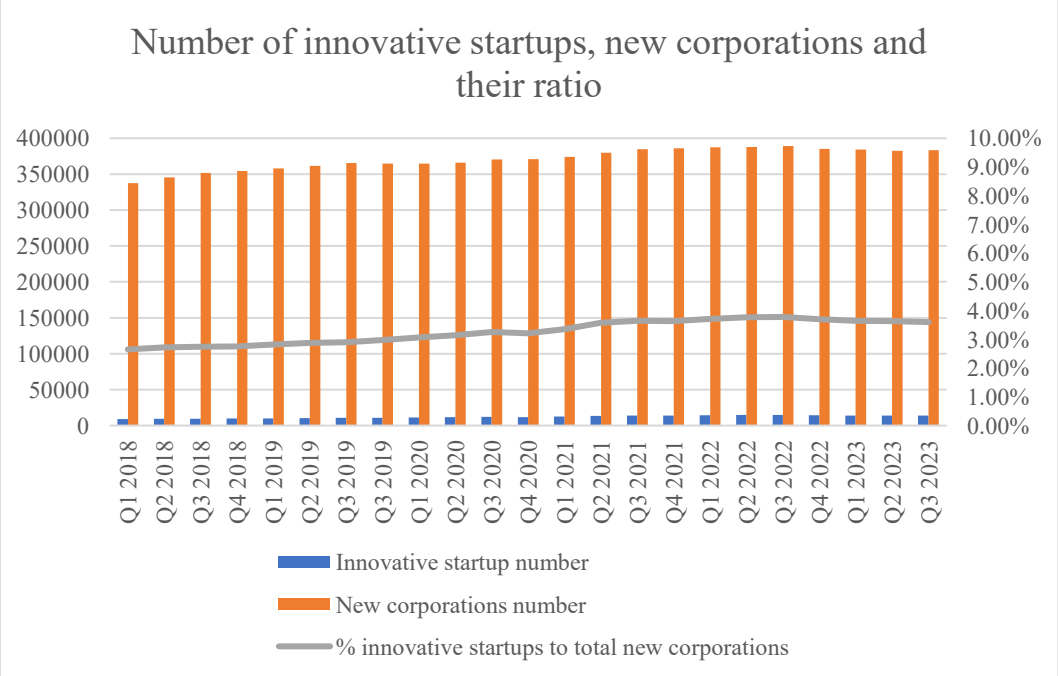


Figure 1: Number of innovative startups, new corporations and their ratio

Figure 2, on the other hand, shows the total registered capital declared by innovative startups, which is increasing, unlike that of new corporations. Very interesting fact is the sharp increase in the percentage of innovative startups that are profitable, rising from 43.37% to 50.08% at the beginning of 2023, before a drop to 43.30%, a similar value to the one of 5 years before.

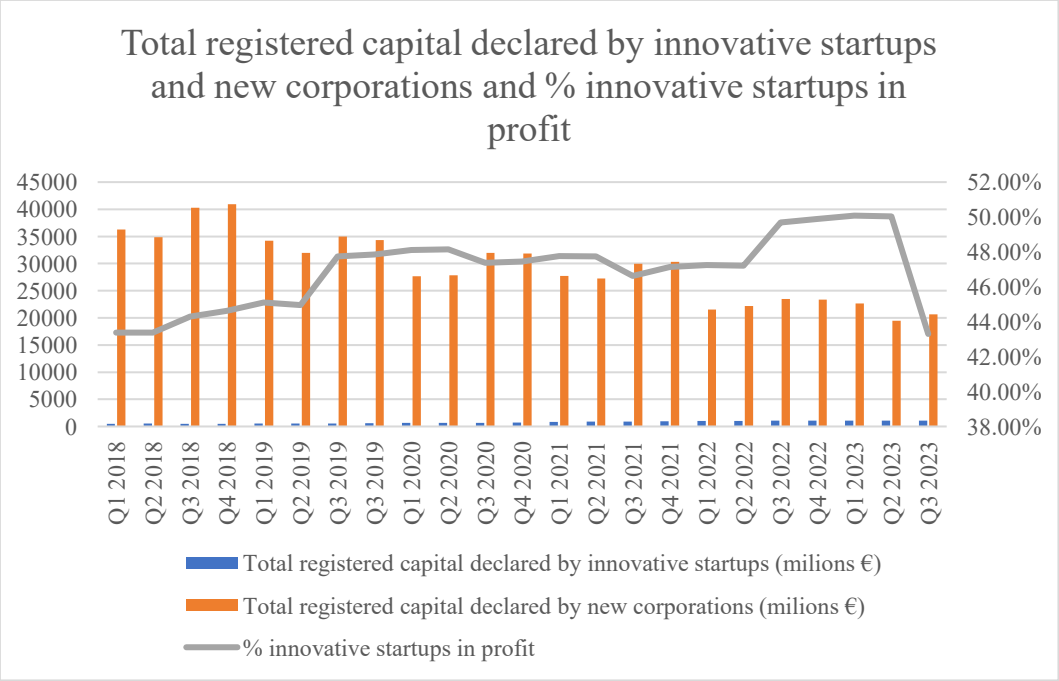


Figure 2: Total registered capital declared by innovative startups and new corporations and percentage of innovative startups in profit

Figure 3, on the other hand, shows the number of female, youth and foreign predominance innovative startups. All three categories have been growing strongly, given in part by incentives for these types of innovative startups dedicated to them, with increases over the past 5 years of 60.23%, 42.33% and 95.20%, respectively, even if in the last two years these grows stopped.

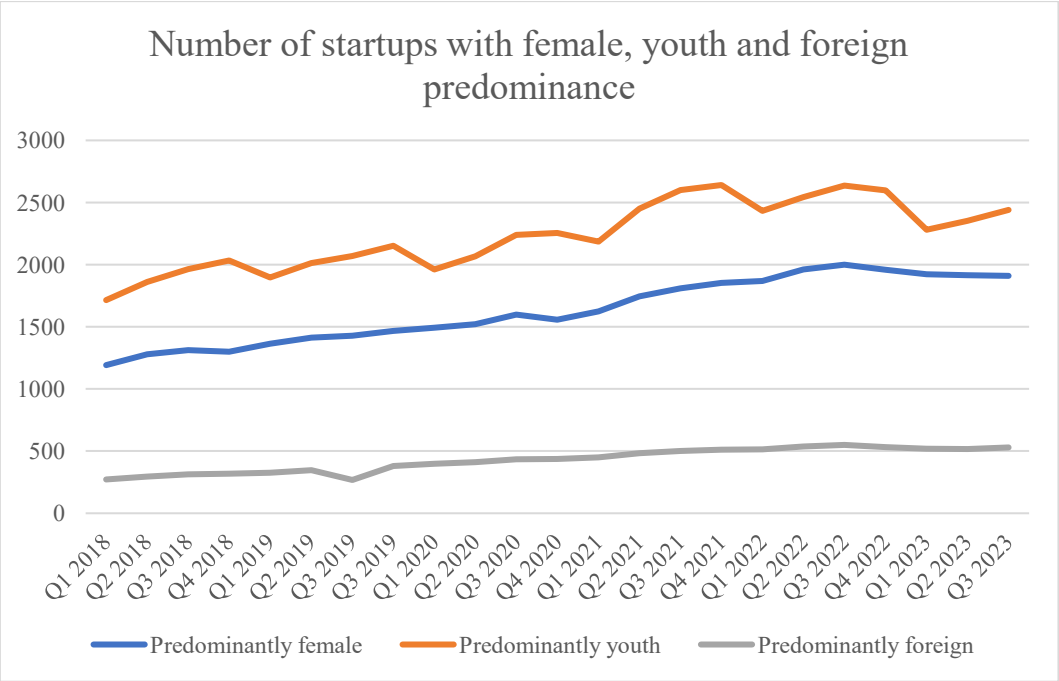


Figure 3: Number of startups with female, youth and foreign predominance

Figure 4, on the other hand, shows the number of innovative startups by region and quarter, while Figure 5 shows a more faithful picture of innovation in the various regions because the number of innovative startups has been normalized to the number of inhabitants (so the number of innovative startups per 1,000 inhabitants per region is shown).

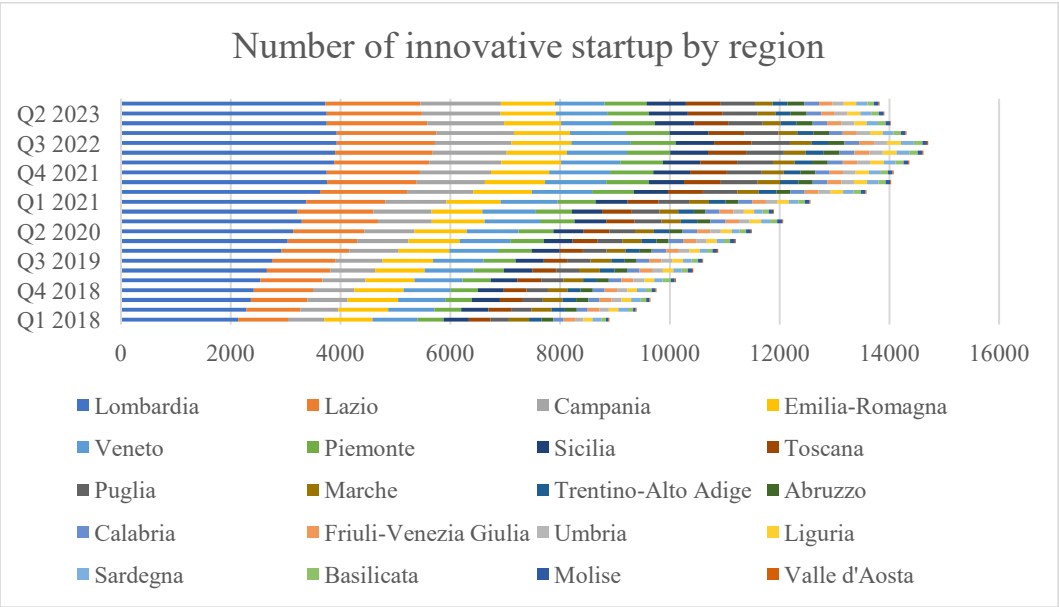


Figure 4: Number of innovative startups by region

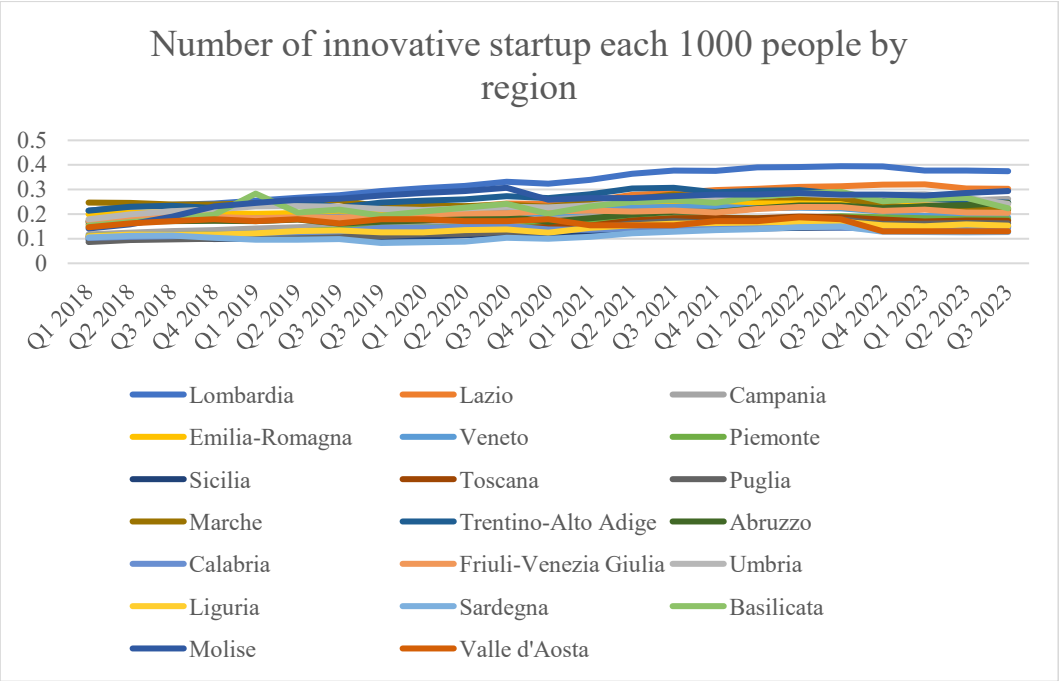


Figure 5: Number of innovative startups each 1,000 people by region

Finally, Figure 6 shows the mean and median values of employees and entrepreneurs within innovative startups in the various quarters over the past 5 years.

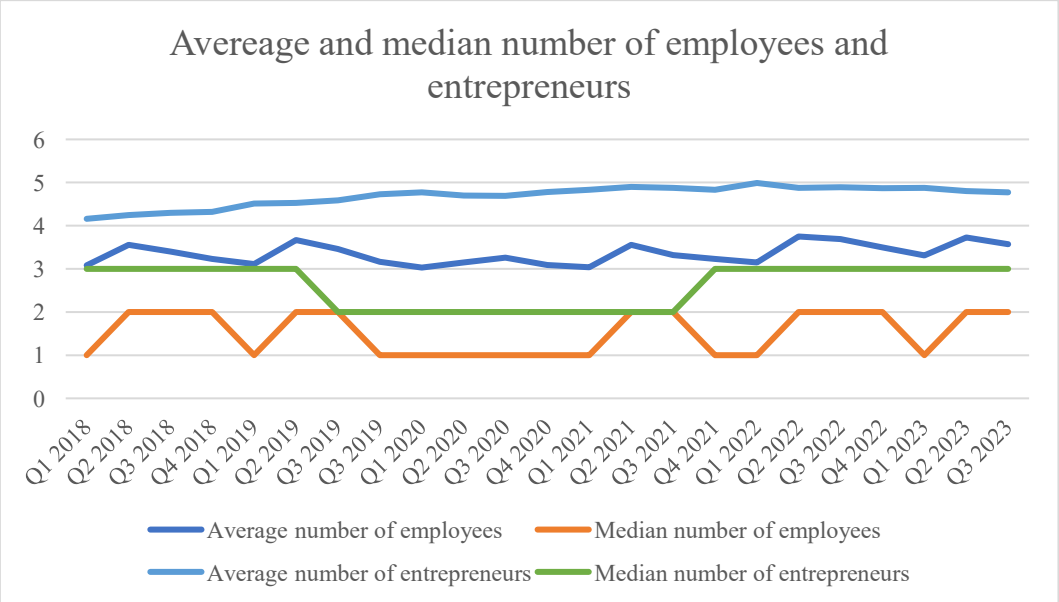


Figure 6: Average and median number of employees and entrepreneurs

1.2. Entrepreneurial finance for startups

Before going into the details of the InnoVenture Lab project, it is certainly useful to make a distinction between the finance used by established and mature companies and that used by startups that are in the startup and growth phase. In fact, while established companies make use of Corporate Finance, startups must make use of Entrepreneurial Finance, defined as "the art and science of investing and financing entrepreneurial ventures" (Alemany, 2018), which can also differ greatly from the former. Whereas Corporate Finance focuses on existing businesses and the goal is to increase shareholder value, Entrepreneurial Finance focuses on the challenge of obtaining capital to test and start a business. Another difference is that while in already established companies managers have data with which can help make predictions, these are not available for a new venture. In addition, in already mature companies the projects that are undertaken have a positive NPV, while new ventures, probably for several years, will have negative profits. The method by which financial returns are obtained is also different: while in Corporate Finance the returns come from the company itself, such as dividend distributions, in Entrepreneurial Finance they come from divesting from the venture. Finally, while in Corporate Finance the investor is assumed to be "rational" (i.e., he or she is return-prone but risk-averse), in Entrepreneurial Finance the investor is not considered to be the "typical" investor, passion and enjoyment also come into play. (Alemany, 2018)

Among the questions an entrepreneur must ask to achieve success are "how much capital is needed?" (which must be consistent with the business model and the minimum necessary to reduce dilution), "when capital is needed?", "what kind of investor to target?", "how to ensure attractive returns?" and "how to approach investors?". (Meuleman P. M., 2022)

Agency problem is also a factor to be considered in starting a startup, as the information available to the entrepreneur and investors is very different, as information about the opportunity is incomplete and uncertain for the entrepreneur but especially for investors. For this, it is necessary to reduce information asymmetry and align goals of the entrepreneur with those of the investor. (Meuleman P. M., 2022)

Raise capital means making a trade-off, given that the entrepreneur gives up stakes of equity for capital. For this reason, the first question the entrepreneur must ask is why he or she is founding a startup and there are mainly three reasons (Meuleman P. M., 2022):

- The “king motive”, when the entrepreneur wants to be "his own boss", so he prefers to have even a smaller business but where he has all or most of the equity and therefore can continue to make decisions;

- The “rich motive”, when the goal is to become rich so give up significant shares of the company is not a problem, the important thing is that his shares are shares of a big and valuable company;
- The “social motive”, when primarily interested in improving the world and society, with ESG issues, than in personal accountability.

This is dealt with by Noam Wasserman in "The Founder's Dilemma", according to which the entrepreneur has to make a choice, between owning a large part of a company that is worth little or a small part of a company that is worth a lot, since the "exception", that is a large part of a company that is worth a lot, is precisely an exception, so difficult to achieve. Of course, it is to be tried to avoid "failure", that is, when one has little control of a company with low financial potential (Wasserman, 2008). Table 1 summarize this concept.

		Financial gains	
		Well below potential	Close to potential
Control over company	Little	Failure	Rich
	Complete	King	Exception

Table 1: The Founder’s Dilemma

The entrepreneur, to keep dilution low, must raise funds at the most opportune times. Since the dilution is calculated by going to divide the investment by the post-money valuation (which is equal to the pre-money valuation to which the new investment is added), the entrepreneur must get new investment when the valuation increases and this happens nonlinearly but following the achievement of a certain milestone (which de-risks the business), decided by mutual agreement with the investors (Skok D. , 2011), as shown in Figure 7:

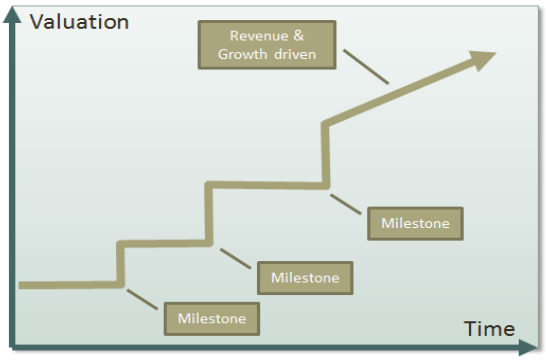


Figure 7: Startup Valuation

The fundamental formulas for valuation and dilution are:

$$Post\ money\ valuation = Pre\ money\ valuation + investment$$

$$Percentage\ dilution = \ \ Investment/(Post\ money\ valuation)$$

Probably the most important milestone is Customer Traction, but also showing that the technology works, achieving a repeatable and scalable sales model and showing that the entrepreneur is able to execute, such as hiring a great CEO and a strong management team (well diversified and balanced), reaching profitability and becoming the market leader. (Skok D. , 2011)

To reduce dilution, one would raise that sufficient but necessary capital to survive between two rounds of investment, whereas any extra amount would go into "wasted dilution". The problem is that it is not always possible to make very precise estimates about the cash burn rate and so it is always better to raise a little more money than what is needed than to risk running out of cash before another investment (reaching the sash out date), because raising capital when there is a dangerous financial situation and time is short will be more expensive. (Skok D. , 2011)

Another factor to be avoided at all costs is a downround, that is when in a later round the valuation is lower than the previous one. (Skok D. , 2011)

So, there is no definitive answer as to what capital needs to be raised. Reasons not to raise capital are if there is no need (the business is cash efficient), because of risk aversion, if the business has low potential or one does not yet have clear vision and experience with professional investors. In case the money is needed, the entrepreneur should take the right amount needed to reach the next milestone, while as much as possible when he needs to scale the business, to become the market leader, to not get distracted and think about business development and attract new talents. (Skok M. , 2015)

The use of different tools to raise capital stems from the fact that a startup is fundamentally and inherently different from a mature company and operates in a different environment, with very different goals, strategies and challenges.

As mentioned earlier, in addition to differences in the life stage of the business, the business model, the organizational structure of the company itself but also the corporate culture, of great importance at the financial level are the following differences:

- Uncertainty and risk;
- Rate of growth;
- Goals.

Uncertainty and risk are obvious characteristics of startups and the environment in which they operate. This is certainly since startups are not yet established businesses; therefore, prior knowledge cannot be used to make other decisions and the market and the technology itself may still be uncertain. The risks associated with this type of business are many but can be summarized as follows (Meuleman P. M., 2022):

- Technological risk: the risk that the developing technology may not work effectively and may become obsolete too soon, failing to meet customer needs;
- Market risk: the risk that the product or service will not be purchased by customers, so the market to which it was intended to sell will not take off;
- Competitive risk: the risk of failing to sustain competition in the market, such as failing to protect themselves through IPRs;
- Execution risk: the risk of the entrepreneurial team failing to achieve its strategy or goals, such as failing in making an executing customer acquisition strategy, attracting and training the right talents, managing investor expectations and handling team conflicts;
- Regulatory risk: the risk of not overcoming existing legal and institutional barriers or the risk of new regulations that could adversely affect the business;
- Funding risk: the risk of not being able to attract enough capital, which is needed to operate and grow.

Regarding the pace of growth, startups often work in markets and with innovative technologies, where being the first to reach a particular milestone is critical; the markets in which they operate are often "first mover takes everything" so using the revenues generated by the company itself to

fund innovation (when they exist, because there are many startups with negative revenues and cash flow), as a mature company might do, is not efficient and, in many cases, sustainable.

The goals can also be very different, given that, while the objectives that are usually pursued in a mature company are profitability and sustainability, so generating positive and secure revenues and cash flow over time, a startup usually aims for growth and expansion and it is usual that even for a long time the startup has negative cashflow and revenues, which is why the financial health of the startup, until it starts to have revenues, is very delicate.

The following (Figure 8) is the life cycle of a startup, where it can be seen the so-called "valley of death", which is that dreaded period when the startup has launched its operations but has not yet generated any revenue. (George, 2016)

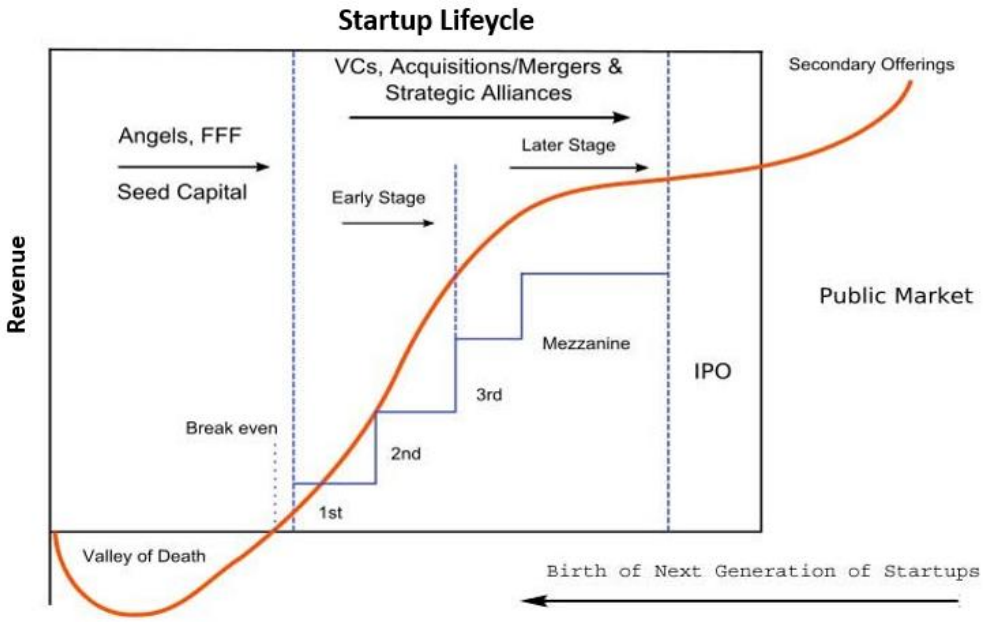


Figure 8: Startup Lifecycle

1.2.1. Factors affecting investors decisions to invest in startups

Before going into detail about all the types of possible ways of funding for startups, it is possible to talk more generally about the important factors that influence the funding process and that can positively influence it.

Some of these factors will be included in the analysis in the form of control variables, while others will not because they were not collected during the project or are difficult to quantify.

Nevertheless, it was deemed important to give a broad and comprehensive overview of major factors that may influence capital raising.

The factors that are discussed are inherent to both the startup itself, regardless of the entrepreneurial team, such as the industry in which it operates or whether it has IPRs; other factors, of no less importance, however, relate precisely to the characteristics of the entrepreneurial team, such as their studies, work experience or whether they have previously founded other startups or not (being “serial entrepreneurs”).

Among these characteristics to be taken into consideration is definitely an innovative and scalable idea, as it needs to be innovative and stand out from competitors, but it also needs to be scalable, to increase their revenues faster than their costs. This is highly sought after by investors because it indicates a potential high return on investment.

There must be present a compelling story highlighting the idea's inception, development and possible market impact that increase the memorability and persuasiveness of the proposal.

The idea itself, although innovative and scalable, is not enough. That requires an excellent Business Plan, showing investors exactly how the company plans to generate profits, through goals, strategies, sales, marketing and financial forecasts. (Paul Burns, 1996)

In addition to the Business Plan, which is undoubtedly of paramount importance, the Financial Model must also be impeccably done (Alemany, 2018): financial information must include estimates of revenues, expenses and cash flows, as well as demonstrating current capital needs and how these funds will be used to foster growth and profit.

If market validation is present, the risk of the venture is decreased, making it more attractive to investors, who are risk adverse (Myers, 2014). This must be demonstrated with first sales, preorders or favorable reviews from the public.

In addition to market validation, traction is also required (Myers, 2014), i.e., observable progress, such as increased users, revenue or other KPIs. It shows that the company has a viable market and that its approach to growth is effective.

To maintain a prosperous firm, it is essential for the startup to possess a competitive advantage over its rivals (Porter, 1985). This advantage might arise from superior technology, valuable assets, exclusive partnerships or entrance barriers that are challenging for competitors to overcome.

Intellectual property rights (IPRs), such as patents, trademarks and copyrights, have the potential to offer a firm lasting protection of its competitive advantage (Roy, 2013). Additionally, they can

enhance the market valuation of the startup in the perspective of investors by protecting its inventions and goods from competitors.

A startup must be flexible and adaptable to different scenarios. Rapid adaptation to market opportunities, obstacles and changes can be crucial to a startup's long-term success and to increasing its attractiveness to investors.

The age of the startup also plays an important role (and thus its growth stage). A more mature startup may be seen as a safer investment, especially if it already has a track record (Alemany, 2018). On the other hand, investing in a startup that is still in its early stages of evolution, thus with a low valuation, may be more attractive from the point of view of return on investment, although riskier.

The industry in which the startup operates is very relevant. It is evident that certain industries possess a greater capacity to attract capital compared to others. For instance, businesses that exhibit lower levels of capital intensity, such as the services sector, demonstrate this phenomenon. (Nguyen, 2020)

The startup's legal structure can significantly influence the impression of its risk, either attracting or deterring potential investors from investing in it. For example, a SRL (LLC) may be viewed as a more secure legal form, given that investors are typically responsible only up to the amount of their investment in the company.

The increase of attention towards corporate social responsibility and environmental sustainability, exemplified by the utilization of ESG Key Performance Indicators (KPIs), has the potential to enhance the public perception of a business and appeal to investors that prioritize favorable social and environmental outcomes.

The availability of an extensive network of potential clients, collaborators, advisors and other resources facilitates the development of businesses and demonstrate to investors the team's ability in navigating the entrepreneurial environment.

As already anticipated, there are other variables concerning strictly the entrepreneurial team (or human capital more generally) that are of great importance too.

Among them a larger number of entrepreneurs can positively affect both decision making, given that there are more points of view on the same problem, positively impacting performance (although too large entrepreneurial teams can, on the other hand, be counterproductive) (Tamvada, 2011). In addition, investors prefer startups with entrepreneurial teams consisting of several people instead of individual entrepreneurs. (Teltch, 2021)

Like the number of entrepreneurs, the number of employees can also be relevant given that startups with more employees have more and different skills within them; moreover, in the startup environment, employees are often motivated by their managers to bring new ideas to improve the startup.

Fundamental is the university background of the entrepreneurs (but also of the employees). This involves the level of education, so whether entrepreneurs have earned a bachelor's degree, master's degree, PhD, or other, as well as the course of study and university attended. Studies in business, finance but also technical fields can be useful.

A common background, which may relate to the same course of study, university or company by two or more startup entrepreneurs is a relevant thing as it may highlight the fact that these entrepreneurs may have very similar approaches to decision making, while in some cases it is more useful to have different approaches and points of view on the same problem.

Prior work experience is another important element of human capital. In this context, experience in technical but also financial fields is particularly relevant, useful in knowing the "rules" of the capital raising world.

The number of years spent in the startup's industry can also positively affect both decision making, as one already has experience in the industry in which decisions need to be made and the collection of funding, as this is a trait highly sought after in entrepreneurial teams by investors.

It is also relevant whether the startup has within the entrepreneurial team one or more entrepreneurs who have previously founded another venture. The experience gained in the field is, in fact, invaluable and investors, if the entrepreneur has been successful, are more likely to entrust the startup with their investments, as they can rely on an existing track record. (Teltch, 2021)

Certain biographical characteristics of the entrepreneurial team may influence the decision of entrepreneurs in entrusting them with their investments. For example, it is well known that female entrepreneurs have a harder time getting funding, given the same skills and characteristics of their startups as those of their male counterparts (TEDx, 2017), since “investments in companies founded or cofounded by women averaged $935,000, which is less than half the average $2.1 million invested in companies founded by male entrepreneurs” despite some studies demonstrate that “startups founded and cofounded by women actually performed better over time, generating 10% more in cumulative revenue over a five-year period” (BCG, 2018). The age composition of entrepreneurs or their nationality may also be elements that influence investors' choices.

More in general, also the ability to perform is important, so the ability and effectiveness with which a group of entrepreneurs can implement and realize their business vision, due to technical skills, industry experience, leadership and adaptability.

1.2.2. Sources of funding for ventures

The financial resources that can be considered depend on several factors, including the stage of development of the startup, the business (e.g., whether it is very capital consuming or risky), the amount of funding needed, whether other assistance than financial (such as managerial or technical) is needed and based on the equity stake the entrepreneur wants to maintain.

Based on literature searches and the funding sources that have been most widely used by startups that have joined the InnoVenture Lab project, the following are the main ways of funding that can be used by startups:

Financing methods that invest in equity include:

- Bootstrapping (personal fund of the entrepreneur);
- F&F (family, friends, fans and fools);
- Crowdfunding;
- Incubators
- Accelerators;
- Business Angels;
- Venture Capitals;
- Equity by companies;
- Private Equity.

While the ones that invest in debt are:

- Personal debts incurred by entrepreneurs;
- Debts of family and friends;
- Bank loan;
- Grants;
- Convertible note.

Other families of funding are also Family Offices and Public Support Programmes.

Using the right source of financing also depends on the stage the company is in. Usually, four to six stages of development in a company's business lifecycle are highlighted; a pre-seed, seed, startup, expansion, a late phase and finally IPO are depicted in Figure 9 (Meuleman M. , 2022). The relationship of Revenues according to financial stage and which financial instrument are the most appropriate is also shown:

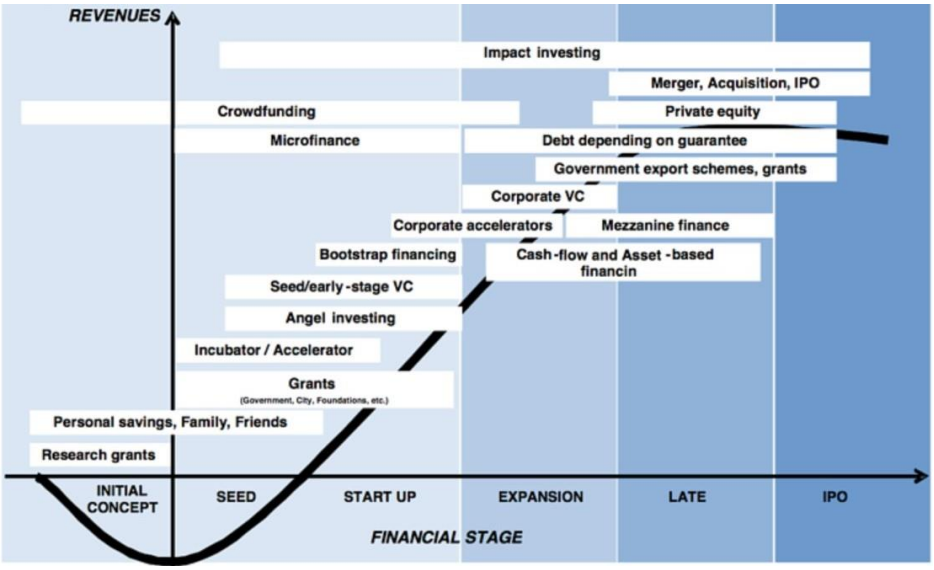


Figure 9: Funding by stage

Luisa Alemany, in her book "Entrepreneurial Finance - The art and science of growing ventures", instead groups the stages of the company life cycle into four: seed, startup, growth-expansion and maturity. (Alemany, 2018)

The Seed stage begins with the development of a new idea or product and ends with the acquisition of the first customer. Its duration is not fixed but depends on the type of business (from a week for consulting to years for biotechnology). To finance this phase the entrepreneur can rely on bootstrapping, F&F, research grants and public funding, crowdfunding campaign, incubators and accelerators, BAs and VCs (although the latter usually invest more in the startup phase).

Start-up Stage is that stage in which the venture is already selling its product or service, or at least has customers. This stage ends when "break-even" is reached, that is, when the venture manages to cover all costs. Funding can come from BAs and VCs (as a rule of thumb, if the business needs less than 1 million euros it can rely on the former, if not the latter).

Growth Stage starts when the startup reached break-even and becoming profitable. Profits can be used to finance growth, but help can also be sought from banks.

Maturity Stage begins when market or business growth stabilizes. At this stage the focus is on managing the business and investment takes a back seat. If someone wants to acquire a business, however, it can be done through PE (Private Equity).

The funding sources mentioned above are the main ones and those that will be discussed in detail below, but there are others, as shown in Figure 10 (Alemany, 2018), divided by stage:

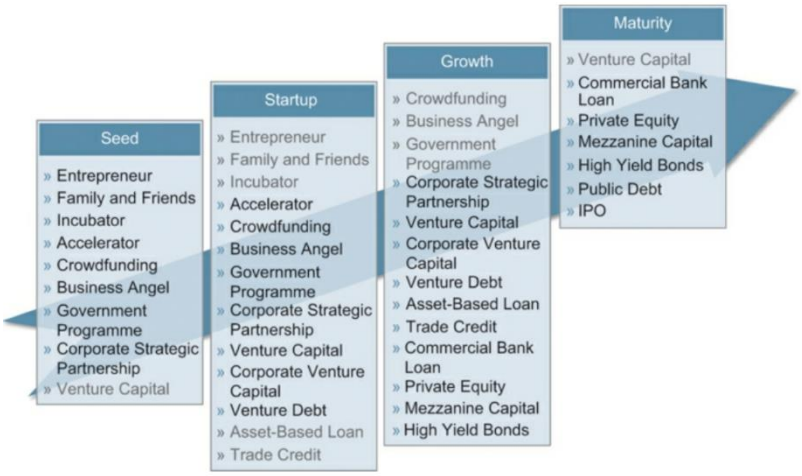


Figure 10: Sources of funding divided by stage

Crowdfunding

Crowfunding is a funding process that has developed in recent years, thanks to Web 2.0, which connects the entrepreneur directly with a crowd of people through online platforms, giving even the individual the opportunity to participate in startup creation with unprecedented ease (OECD, 2015). By using these platforms, individuals can find a multitude of projects that might interest them and follow the startup from its conceptualization. On the other hand, entrepreneurs can also benefit from using this method, as, in addition to raising capital, they can relate directly with individuals not only to define project goals (in the form of customer needs) but also to gain know-how and inspiration from them themselves, as they become "co-authors" of the project itself. For this reason, this method cannot be considered just a fundraising method, but a true anthropological, social and economic phenomenon.

There is not just one type of crowdfunding, but several and they are defined primarily by the type of return the investor gets. For this reason, they can be divided into four main categories (Hossain, 2017).

Reward based crowdfunding refers to a crowdfunding model where investors are not provided with a monetary return, but rather receive a tangible product or service from the project or initiative, as well as an opportunity to engage in an experiential or interactive meeting with the project's entrepreneurs.

Lending based crowdfunding refers to a form crowdfunding where investors assume the role of creditors and, similar to loan providers, seek to gain from the repayment of the borrowed amount along with accrued interest.

Donation based crowdfunding refers to a type of crowdfunding where investors do not anticipate any financial gain but choose to invest for reasons other than financial gain, such as environmental, social and governance (ESG) considerations.

Equity based crowdfunding refers to a form of crowdfunding where participants buy shares in a firm, thereby assuming the role of true shareholders and thereby gaining the opportunity to capitalize on its expansion. This particular form of crowdfunding is widely prevalent and will be further examined in the next section.

Equity based crowdfunding

This type of crowdfunding involves obtaining risk capital through the Internet: investors receive part of the startup's equity in exchange for their monetary investment, becoming true owners of the business. To do this, the entrepreneur pitches his idea on a certain online platform, such as Indiegogo and Kickstarter, and potential private investors decide whether to take part in the fundraising, based on the information that has been posted and the stated goal.

Equity crowdfunding differs from other methods of getting financial investment, such as business angels (BAs) and venture capitals (VCs), since the latter involves a direct relationship between the startup and the investor. In contrast, crowdfunding involves a larger group of small investors, some of whom may also become customers. For this reason, this method of financing can be very useful for SMEs, thus also for startups, as it reduces financial dependence on conventional financial methods that require well-defined business plans and precise potential returns on investments. Moreover, the advantage is not only financial, so being able to access capital that would be impossible with other financial methods, but this process combines the financing itself with investor participation that is hard to find in other financing methods. In fact, there is an affinity between the company and the investors that results in a sense of unity and the creation of a community, which is essential for the growth and goal setting of the startup.

On the other hand, this concept is also attractive to small investors who have modest financial means and still want to participate, with what they can, in the development of startups of their interest.

However, it remains a very new mechanism; therefore, many countries are interested in regulating this practice, defining its boundaries and preventing frauds.

So, the advantages of this method are (Golić, 2014):

- Increased access to funds: crowdfunding gives SMEs a platform to acquire funds from a bigger pool of investors, which might be difficult through traditional financing methods;
- Crowdfunding allows SMEs to diversify their sources of finance beyond traditional loans or investments, decreasing reliance on a single funding channel;
- Crowdfunding campaigns can boost SMEs' visibility and serve as a marketing tool, allowing them to reach a bigger audience and attract potential clients or partners;
- Validation of Business Ideas: crowdfunding campaigns that achieve success can confirm the market demand for a product or service, providing valuable feedback and insights to SMEs;
- Crowdfunding provides a variety of funding options, including equity crowdfunding, reward based crowdfunding and donation based crowdfunding, allowing SMEs to select the most appropriate choice for their financing needs;
- The crowd is involved in the project: crowdfunding, unlike other project developments, can have immediate and constant feedback from potential customers, so the idea can be pointed in the right direction more easily;
- The network: in crowdfunding very important is the network that is created, which is essential to find not only new potential clients and investors, but also new collaborators;
- The marketing: the crowd often invests not only money but also time by talking about the project on social medias. In this way, the company can save money on marketing campaigns;
- Easier process: this method of funding can be considered easier and faster than others because it is done online and there are not yet many regulations in place. What is sufficient is for the entrepreneur to set a well-defined goal, make a business plan that can be understood by potential investors and a video with which to explain the startup to potential investors;

- Low cost: compared with other funding methods, crowdfunding can also be very cheap.

While some possible disadvantages may be (Alberdi, 2021):

- Ideas can get stolen: there is a risk that the idea will be stolen as it has to be made public to the general public to raise investment and, being in an early stage, the entrepreneur hardly has the financial means to be able to protect the idea with IPRs, such as patents;
- Reputation: in the case of a startup or project failure, the failure is public, which can damage the image of the entrepreneur, impairing the development of future ideas;
- Underestimating time and costs: although it has been said that compared to traditional methods crowdfunding can be better from the point of view of time and money management, if the crowdfunding campaign is not done in the right way, it can become time and money consuming too. Among other costs there are platform fees;
- Legislative complications: since legislation is not yet well defined and equal in all countries, something that can be done now may not be done in the future or in another country;
- Heterogeneous investors: investors who join fundraising through this procedure can also be very different from each other, with different goals and expectations, so managing such a fundraising campaign can be complicated;
- Equity dilution: the entrepreneur in order to obtain financing, through the transfer of equity, is in fact relinquishing part of the control of the company, with the consequent negative implications (e.g., the imposition on the entrepreneur of certain ideas or methodologies to be followed), although it should be emphasized that control is not being ceded to one or a few investors, but to a multitude, in which no one will have, alone, great decision-making power;
- Professional investors: in certain jurisdictions, there exists a requirement for a specific proportion of professional investors to participate in a fundraising campaign. This requirement can pose challenges for small businesses seeking to raise capital. Failure to meet the minimum threshold of professional investors may result in the rejection of the campaign, even if it achieves success;
- Re-selling: investors participating in a crowdfunding campaign may face a time constraint that prevents them from selling their shares in the firm, so restricting

their ability to terminate their investment. Furthermore, an additional challenge arises from the fact that the equities are privately held and there is no public market where to sell them, necessitating the investor to actively seek for a buyer.

The regulations regarding crowdfunding in Italy refer to Decree Law No. 179/2012, converted into Law No. 221/2012, which was enacted because it was deemed extraordinary to need to enact measures to foster growth, development of the economy, digital economy and technological innovation. (Presidenza del Consiglio dei Ministri, 2012)

In Article 30 of this Decree Law, it is defined exactly what is meant by crowdfunding for Italian law, namely, "it means an online platform whose exclusive purpose is to facilitate the raising of risk capital by innovative start-ups, including start-ups with a social vocation". (Presidenza del Consiglio dei Ministri, 2012)

In this decree, in addition to defining the concept of innovative startup, it is defined that the power to regulate equity crowdfunding in the country is also delegated to Consob.

Since it is intended to ensure reliability and quality, those who can manage the online raising of risk capital are (CONSOB, 2012):

- Subjects authorized by Consob and listed in a special register maintained by the same authority;
- Banks and investment firms already authorized to provide investment services.

To establish credibility and generate attention, an effective crowdfunding campaign must be meticulously planned and executed, including the creation of interesting content such as videos and detailed project plans. It has to promote transparency and extensive explanations of the project's worth and financial projections to attract investors. Maintaining and increasing interest after launch is critical and this can be accomplished through intriguing pitches, updates and interactive events, as well as using various communication channels to collect feedback. Successful campaigns focus on project execution and investor rewards, which are influenced by elements such as the composition of the entrepreneurial team, community building, advertising techniques and crowdfunding platforms' global reach.

Incubators

Incubators, like accelerators and crowdfunding, being sources of funding that have developed since the 2000s, have no precise and unambiguous definition, although the first incubator concept can be found in 1959 in the Batavia Industrial Center in New York (Alemany, 2018). In addition, the terms incubators and accelerators are also often used to mean the same thing, since they have many similarities, but this is not quite correct.

Generally speaking, incubators are organizations that give support to startups that are still in the early stage, providing them with different kinds of resources, primarily a physical workspace, mentoring, training, networking and sometimes even funding.

Incubators, which can be public or private, are present a lot in universities and colleges (such as, for example, i3P at the Politecnico di Torino), but also in corporates. For universities, they are very important because they incentivize their students to pursue entrepreneurship, as well as making the university itself more reputable (there are rankings regarding university incubators, such as UBI Global). Incubators related to corporates, on the other hand, serve to develop new innovative business ideas, while still related to the core business and retain employees with entrepreneurial aspirations. Incubators have a great impact on the local ecosystem, creating jobs and developing the economy. (Alemany, 2018)

Access to incubators may be precluded only to those individuals who are part of a particular university or corporate; in addition, there will also be a selection that is based on the qualities of the individual.

A key element in the incubator is the mentor, selected on the basis of his knowledge and experience, who determines the success of the entrepreneurs (with whom he will be in continuous contact) and thus the incubator’s success. He does not have to tell entrepreneurs what to do but has to give them guidelines and help them develop their own approach; he also does his job unpaid but, in addition to his desire to give support to young entrepreneurs, he can take part in new and promising ventures. In addition to the mentor, a determining feature of the incubator's success is the network and experts who are invited to give presentations, helping entrepreneurs and inspiring them. (Alemany, 2018)

Incubators may specialize by industry or type of startup and their program may last from months to years, while financial aid may be no or small.

Accelerators

Although both incubators and accelerators position themselves in the early stages to give support to ventures, the former "incubate" ventures, while the latter "accelerate" them. (Alemany, 2018)

Like incubators, accelerators have a physical location where the various entrepreneurs can work on developing their ventures but, unlike the former, the process of entering the program is free to anyone (so people don't have to be part of a particular university or corporate but still need to have a startup that matches the accelerator's characteristics) and done on a "batch-wise" basis. This way all entrepreneurial teams start the journey together and will finish it together about 3-6 months later with the "Demo-day", when entrepreneurs pitch their ventures to investors attending the event. Although anyone can (at least potentially) get into these programs, actually getting in is really difficult; the acceptance rate can also be very low, reaching 1.5 percent for the Y Combinator in 2014, in the U.S. (Alemany, 2018). Therefore, succeeding in an accelerator means gaining a significant competitive advantage over other startups and differentiating themselves.

Not all accelerators are the same; they differ based on their area of specialization, type of program, program intensity, quality of teaching and the network they rely on.

What is taught is generic and covers all the topics that will need to be addressed by the entrepreneurial team during startup development, such as "development of concepts, creating the vision and mission of ventures, assessing the market size, reviewing different business models, profiling and team building, working out the preliminary financials and preparing a compelling proposition for future investors" (Alemany, 2018). All of this is taught intensively, as the duration of the program is rather short and this can result in one of the downsides of this tool, which is being overwhelmed by the process itself, which can distract the entrepreneur from other important things, because of the many meetings that have to be done. The activities that are carried out in an accelerator involve validation, adaptation and acceleration, in line with the lean startup methodology. The ultimate goal remains growth.

Exactly as in incubators, the figure of the mentor, who is responsible for supporting the teams with whom he or she must remain in close contact throughout the duration of the program, has a major influence on the quality of the accelerator itself.

The advantages for a startup working with an accelerator are obvious. In addition to the network that is created with entrepreneurs taking part in the program, partnerships with corporates are also essential. Being selected by an accelerator means having a better chance of attracting capital in the future, having a steep learning curve and being able to count on a lot of hands-on experience.

The positives are not only about the entrepreneurs but also about the area where the accelerator resides, going on to create a positive impact.

Negatives include the fact that this program could confuse the entrepreneur because he or she might receive different advice from different people. The goal of obtaining funding during the Demo Day could also distract the entrepreneur, overshadowing the customer and the value proposition. Demo Day itself could result in issues because it is true that many investors attend this event, but it's never sure if they are willing to actually invest in one of these startups. Finally, the last thing that could hurt the entrepreneur is the business model of the accelerator itself, as it consists of asking for a stake of the venture's equity, in exchange for funds, which usually range between 20k and 100k euros, even going up to 200k (as with EcoMachines), in exchange for an equity stake that averages around 8 percent (Meuleman M. , 2022); the issue lies in the fact that this equity stake, while small, is no-dilutable until a certain threshold of venture valuation is reached, going to protect the accelerator but harming the entrepreneur, who often underestimates the impact of this clause (Alemany, 2018). Some accelerators instead require a stake without giving funding, while others provide loans or grants. In some cases, in addition to the stake, they may also require a fee (between 600 and 30k euros) to participate in the program (Meuleman M. , 2022).

In addition to "classic" accelerators, which serve to accelerate business in the early stages, there are also accelerators that in later stages help established companies, thus already generating revenues but failing to realize their full potential, to "scale-up".

Business Angel

In the seed, startup and early growth stages, another source of investment can be "high net worth individuals who invest their own money, together with their time and expertise, directly in unquoted companies in which they have no family connection, in hope of financial gain, through an exit" (Mason, 2007) commonly known as Business Angels.

Since BAs are not organizations but individual private investors, it is also important to give an overview of the typical investor. In most cases it is a middle-aged man with a background in economics or business, who has been an entrepreneur in the past. The percentage of women, on the other hand, hardly exceeds 20% (EBAN, 2019).

These investors are active ("hands-on") investors, providing, in addition to funding, advice and access to their network. They usually invest from 10,000 to 100,000 euros (or up to one million if they invest with several BAs together) and have a portfolio consisting of two up to five

investments. They usually require a minority equity stake (about 15-20%) and a board seat. Unlike other investors, such as Venture Capitalists, they make investment decisions themselves, without delegating that decision to managers, they invest their own money, and not other investors' money that has been raised in a fund and they invest only if they find really interesting investments, as they do not have a limited period in which to invest; in addition, since they do not have to justify their choices to anyone, they can make the investment process faster (usually 1 to 3 months) and the due diligence process is also less expensive, as investing in the initial stages makes the process simpler; finally, they can invest using the criteria they most prefer, without having to follow those that are stipulated at the beginning of the creation of a Venture Capital fund (such as being able to invest only in determinate businesses or geographic areas) (Alemany, 2018). Another difference lies in the "agency problem", because while VCs draw up even very in-depth but complicated contracts to protect themselves, BAs overcome this problem with active involvement and investment in startups that are geographically closer, thus better controllable (Alemany, 2018).

These investors invest primarily for financial return but also for hedonistic and altruistic motives, such as impact investing.

One can summarize the main differences between Business Angels and Venture Capitalists, which will be discussed in detail later, as in Table 2 (Szulczewska-Remi, 2019):

MAIN DIFFERENCES	**BUSINESS ANGELS**	**VENTURE CAPITALS**
PERSONAL	Entrepreneurs	Professional investors
STAGE FOCUS	Early-stage, focus on younger companies	Early-stage, Expansion, Later-stage
DUE DILIGENCE	Minimal	Extensive
RESPONSABILITY	Personal financial responsability	Personal financial responsability and responsibility to shareholders
LOCATION OF INVESTMENT	Local	Not important
CONTRACTS	Simple	Complex
MONITORING AFTER INVESTMENT	Active, “hands-on” and advisory role	Strategic and representation on supervisory boards
EXIT	Less important and patience	Very important and not patient

RATE OF RETURN	Of lesser concern and modest return	Highly important and high returns

Table 2: Business Angels and Venture Capitals differences

It is not easy to get an accurate idea of the number of Business Angels present, as not all of them join networks (such as EBAN for Europe or IBAN for Italy); in fact, the BAs market is called an "invisible market". Nevertheless, it is true that a more structured market is being created, where business angels join together in networks, following certain routines and specializing by industry sector, type of investor and affiliation, some of which are managed by the members themselves while others are managed by managers (known as "gatekeepers"). This can lead to certain benefits such as (Alemany, 2018):

- Raise more capital and be able to make follow-on investments, as this would be difficult for a single business angel to do;
- Save time and money on some procedures that need to be done for every startup, such as due diligence;
- Being able to be visible to entrepreneurs and get a continuous flow of proposals, saving on search costs, but also to investors with great wealth who could take part in the network;
- By collaborating together, business angels are able to share all their professional experience and help even better the businesses they invest in.

There are also downsides given that, by collaborating in this way, the individual investor's behaviour is influenced, even to the point of ignoring the information he or she has and imitating what is being done by another investor. This results in a reduction in investment diversity (Alemany, 2018).

Below Figure 11 shows the growth of the Business Angels market in Europe, according to the EBAN Statistics Compendium 2021 (EBAN, 2021):

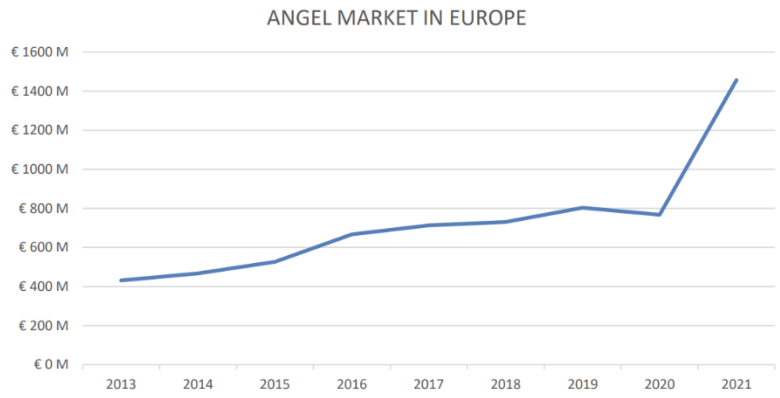


Figure 11: BAs Market in Europe

The strong growth can be attributed to the introduction of fiscal incentives, including the Enterprise Investment Scheme, the establishment of networks and collaborative investment initiatives with other financial institutions.

The investment process is divided into three main stages: deal origination, deal evaluation and finally negotiation and contracting, which will then be followed by post-investment activity. After finding a potential startup, usually through his or her network of acquaintances, the business angel evaluates it, both based on its investment criteria (such as geographic location, the investment required and the nature of the business) but also based on whether it knows the industry and whether it can add value. These steps can be carried out in very little time, no more than 10 minutes and more importance is given to the market, financial considerations, the product or service and even the entrepreneur (one of the key elements, as it is with him or her that a relationship of trust must be established), rather than relying on the business plan. In case the business meets all the requirements, the entrepreneur and the BA have to agree on the terms and conditions, as well as the valuation of the startup and anything regarding the shares. Some of these are less relevant and the investor can come to the entrepreneur's side, while others are of paramount importance and non-negotiable (such as veto rights over acquisitions/divestments). The difference between a BA with experience and one without is that the one without experience will spend a lot of energy in putting so many protections in the contract, while the one with experience will focus only on those that affect the financial return. It should be emphasized that the contract must be fair to both parties, as a contract that would harm the entrepreneur would be bad for the entrepreneur's motivation and this would harm the investor himself. (Alemany, 2018)

The funding funnel usually out of a sample of 100 business plans received, sees evaluated about 31 of them but only 7 of them finally get funding. (Alemany, 2018)

After investing, it will be necessary to monitor the entrepreneur's performance and, as mentioned above, the best way is involvement (which is why many BAs invest locally), but this is not so much seen as "monitoring" but more as "helping". Sometimes they interact a few times a week or a month with the entrepreneur, sometimes so much that they seem to be part of the entrepreneurial team. The help they give can be of different kinds, but prominent among them is helping the business obtain future financing.

Finally, like all other forms of financing, there comes a time to get the reward from the investment (the harvesting) and it typically consists through a liquidation, usually a trade sale or, though less common, an IPO, rather than from an income stream. Unlike VCs, who place a great deal of importance on the exit, for BAs the exit is a secondary thing (which may come after seven or more years), as they think that a "good investment will always find exits". In general, about half of investments fail while a small fraction of investments generates returns greater than 10x. (Alemany, 2018)

In general, BAs can be very useful for those startups that need not-overly-large funding and other very specific types of help, besides the fact that startups that are pursued by these investors are usually more likely to survive, obtain other future funding and achieve a successful exit (W. Kerr, 2014).

As for the Italian market, there are an estimated 1,500 active BAs, concentrated mainly in the north (with 68% of the entire population). They are estimated to have invested approximately 93.3 million euros in 2021 (Cimpanelli, 2022).

Measures have also been made in Italy to stimulate the growth of these investors, such as the "Decreto Crescita" by which "investors who make investments in startups are entitled to a deduction from the gross IRPEF tax equal to 30% of the amount invested, up to €1 million, provided that the participation is maintained for at least 3 years," amended by the "Decreto Rilancio" by which the tax deduction was increased to 50% with a ceiling of €300,000 for innovative SMEs (and €100,000 for startups).

Venture Capitals, Private Equity and Corporate Venture Capitals

Unlike Business Angels, who are in fact people with a large wealth to invest, there are then funds that raise capital from various investors (such as affluent investors, institutions, the financial sector and other asset managers) and then invest it in ventures. These alternative methods of financing are:

- Venture Capitals;
- Private Equity;
- Corporate Venture Capitals.

Somewhat like what happens between Incubators and Accelerators, Venture Capitals and Private Equity are often confused, when VCs should be considered a subcategory of PE, despite the fact that it is gaining increasing prominence.

Both are "temporary equity investors that provide capital, in exchange for equity (shares), to non-listed companies". The main differences are in stage, sector and level of risk. (Alemany, 2018)

The types of VCs, in addition to the independent VCs and CVCs that will be discussed, include those affiliated with banks and governments.

Venture Capitals

Venture capitals usually invest in companies that are in the early stages of development and are involved in innovative and disruptive product technology or scientific-driven businesses. Because they are businesses in the early stages of development and based on unproven technologies, the level of risk is extremely high, but at the same time the potential returns are incalculable.

Venture Capitals are not all the same but differ in size and approaches, being able to go to identify at least three types: Seed, Early stage/Startup and Expansion, as shown in Table 3 (Alemany, 2018):

	SEED	**EARLY STAGE/STARTUP**	**EXPANSION**
SIZE	10-100 million euros	Around 100 million euros	Sever hundreds of million euros
INVESTEE COMPANIES	Early-stage	Scale-up	Mature
COMPANY PRODUCT/SERVICE	Under development	Developed	Solid

INVESTMENT	Less than 1 million euros	Few million euros	Several tens of million euros

Table 3: VCs types

The lifecycle of a Venture Capital fund can be schematized into three phases, a Fundraising Period, an Investment and Monitoring Period and a Divestment Period.

It begins with the search for investors (called "limited partners" who differ from "general partners" who are both investors and managers of the fund) who will commit their capital to the fund for at least 10 years. The capital is not immediately raised but will be "called" by the fund manager when there is a need; in case the investor does not comply with the call the consequences can be very serious, such as the loss of the capital invested up to that time. Investing in this financial instrument is very unusual given that the capital is "frozen" for a very long period, at least 10 years, and the investor does not know in advance which startups the fund will invest in. There are many positives, though, because their returns are uncorrelated with those of the stock market, giving investors the opportunity to diversify their portfolios and, given their long lifecycle, if they invest in companies during a crisis and resell them when the crisis ends they can get huge returns (the opposite if they invest when the market is doing well); the returns are generally higher than other asset classes and they can give information about new industries and innovations, useful for corporations.

Major investors include public institutions (for example, with 1.1 billion euros, or 20.7 percent of the capital raised, in 2015 in Europe) (Alemany, 2018), who have impact investing as an objective in addition to financial return, and corporations, interested in industry knowledge. Among the main objectives is always financial return and investors can use several criteria to decide which VC to invest in (Alemany, 2018):

- Track record: how the investment team has performed in the past;
- The investment team: whether the team has worked together in the past or is a newly formed one, whether it has all the complementary and necessary people within it to achieve success and whether it is motivated;
- Fund strategy: so whether it is in line with the development of the market;
- Market opportunity: so if the fund is investing in an attractive market;
- GPs-LPs alignment: so whether their interests are aligned and what the economic incentives are for the fund managers.

Having created the fund, the team has on average a period of 5 years to find all the startups and invest in them, creating a portfolio of startups, called Investment period, after which the fund cannot invest in new startups but only give follow-on support to those in which it has invested.

Choosing startups is not a well-defined approach, it is more of a "mix of science and art," and the earlier the stage the less quantitative data available and the greater the risk. Nevertheless, VCs look for a clear and innovative value proposition, but not only the idea, but also the ability to execute and that some metrics are shown and a highly scalable business model, usually at least a 10x increase in the value of the startup. The thing they place the most importance on, however, is the entrepreneurial team, which must be able to adapt, manage growth and have an industry background, as the product/service, like the business model, may evolve over time, but not the entrepreneurial team, which is subject to different clauses in the shareholders' agreement. The exit plan is also of paramount importance, on which there must be alignment between the VC and the entrepreneurs (Alemany, 2018). Other characteristics required by VCs are a product that must work, unique, protected by IPRs, demonstrate the potential for product expansion, a market that can grow rapidly and can achieve high sizes, and a business plan that describes everything clearly, including milestones and realistic projections. Also important are the TAM, SAM and SOM[1] of the market, the ability to internationalize, the ability to maintain a competitive advantage, the business model economics (so whether the LTV[2] greatly exceeds the CAC[3]) and traction.

Since these ventures are very risky, the best way to protect against this factor is to diversify the startup portfolio. Many of the startups get unsatisfactory exit multiples and only a small proportion of them pay back their investment, but VCs base their fund's return on that small percentage of startups that generate huge returns. In fact, the managers' goal is to invest as much capital as possible in these "star" startups, but one cannot know in advance which ones they are; therefore, VCs invest in multiple rounds ("stage investing"), following and re-investing in those startups that achieve certain milestones, without wasting resources on those that perform worse. (Alemany, 2018)

Investors, after selecting and investing in startups, will give them help in day-to-day operations, and their background but also their network of contacts will be crucial. This help is important because it helps startups to succeed and thus generate a high return for the investor but also because, through the help and the network of contacts they offer, they can attract the best startups when the entrepreneur has a choice of several investors. Interaction between investors and entrepreneurs takes place through Board of Directors meetings. (Alemany, 2018)

[1] Total Available Market, Serviceable Available Market and Serviceable Obtainable Market
[2] Life time value
[3] Customer acquisition cost

Finally, the whole process ends with the exit, when, through different ways, the startup's equity stake is "sold" to generate the returns for the "temporary" investors (since it is known from the beginning that the collaboration will have an end). At this stage, the term sheet is crucial, in which, in addition to cash flow, control and compensation rights, two clauses, the "drag-along" and "tag-along", are always included, which protect the VC given that the drag-along, in case there is an attractive buyout offer, allows the VC to force the other shareholders to sell their equity stake as well (on the same terms) since an acquirer usually wants to buy the whole company, while the tag-along is used to prevent one shareholder, particularly the founder, from selling his share of equity leaving the VC out of the deal, forcing the parties to bring him into the deal with his pro-rata of the company shares, but usually this step is done with the common agreement of all the shareholders. (Alemany, 2018)

There are five ways in which there may be an exit. The company has the potential to be publicly traded via an Initial Public Offering (IPO), which is considered a very effective strategy for optimizing the exit price. An alternative method to optimize profits is through a Trade sale, where the company is sold to a major corporation with a strategic interest in acquiring it. Typically, this procedure is managed by independent merger and acquisition (M&A) firms. Secondary sale is to sell the startup's equity stake to another financial investor when new skills are required (such as moving from a seed-stage VC to PE). Share buy-back (or Buyout) occurs when the equity stake is sold back to the entrepreneur (or entrepreneurial team), who will have to apply for a bank loan to buy the shares, which will be granted by the bank only if the startup guarantees the entrepreneur a stable cash-flow, which can guarantee repayment of the loan. And finally, the Write-off, which is a liquidation or dissolution of the startup. (Alemany, 2018) The distribution of exits between IPOs, Acquisitions and Buyouts in Europe is shown below in Figure 12 (PitchBook, 2023) and as can be seen the percentage of Acquisitions is significantly higher than the other forms of exit:

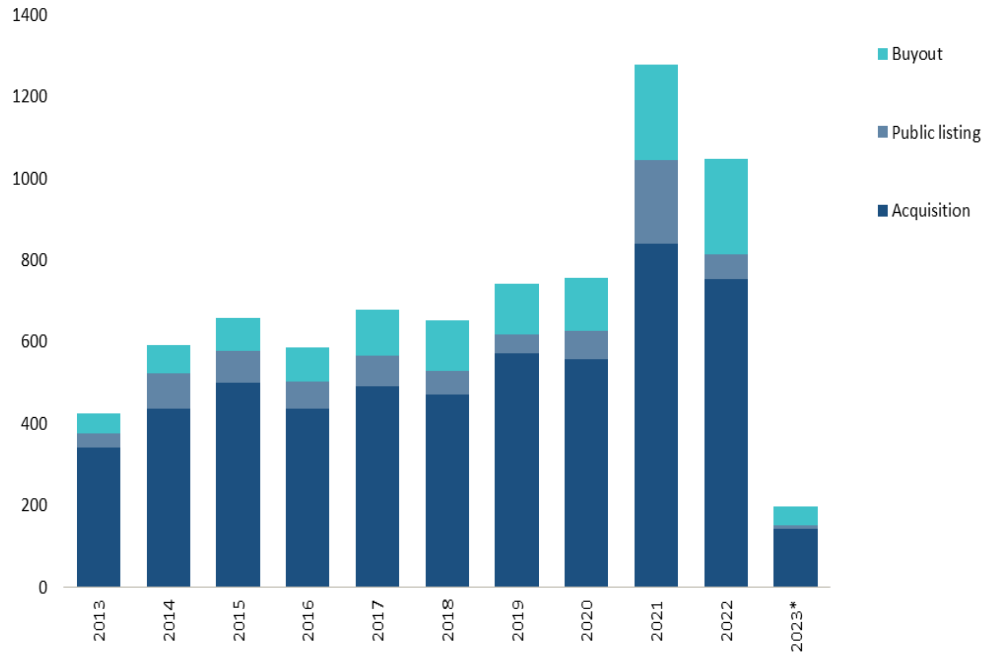


Figure 12: European VCs exits

Venture Capitalists

It is also important to talk about the people behind these investment funds, somewhat as was done with the BAs. They are often entrepreneurs, usually with financial and operations experience (which is necessary to attract investment) and also wealthy, since they must also invest a certain percentage in the fund, so that there is an alignment of interests between GPs and LPs, or professional investors, with a great background in the industry in which they operate with the fund and a large network of contacts, monitoring but most importantly helping the businesses in which they invest. (Alemany, 2018)

Venture Capital structure and economics

The structure of a Venture Capital fund can be very simple but also very complex, depending on the number of funds, geographies and sectors in which they operate, but can be generalized as follows in Figure 13 (Alemany, 2018):

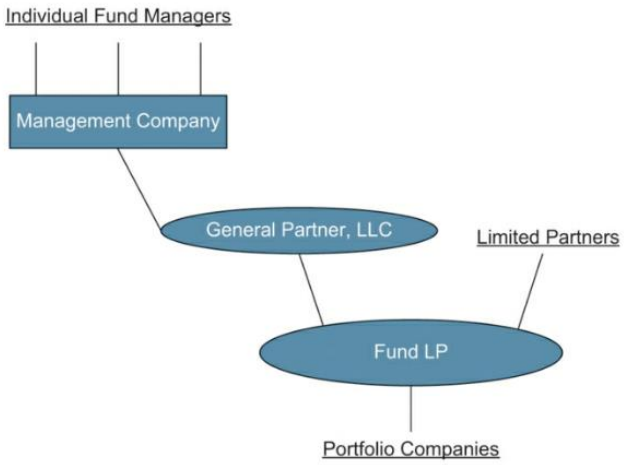


Figure 13: VC structure

It consists of three main elements. The Management Company, consisting of the managers who form the company, responsible for raising the funds, the General Partner LLC, an LLC owned and controlled by the Management Company, responsible for making the investments and divestments and, finally, the Fund LP, a limited partnership in which outside investors (called "Limited Partners") put their money to be invested in the startups.

Venture Capitalists receive a periodic fee to cover salaries and other costs, subject to negotiation between GPs and LPs, which is exercised on the total commitments of the fund in the investment period, while on the net invested capital in the portfolio management period, as there will be less work to be done in this phase as exits will occur, starting at 1.5-2.5% in the first period and then decreasing. The fee also depends on the sector, size and "pedigree" of the fund. But what really motivates Venture Capitalists is the carried interest, a percentage of the fund's profits, but this is not distributed until they are able to return the initial investment to the LPs, plus the "hurdle", a minimum annual return that the LPs expect (usually between 6 and 8%). The extra profits are then divided between the LPs and the GPs, usually according to the 80/20 formula, that is, 80% to the LPs and 20% to the GPs. (Alemany, 2018)

VCs in Italy

Unlike BAs, which operate in a mostly "hidden" market, market dynamics can be more easily tracked for VCs. Although Italy lags behind other European countries, such as Spain and France (in fact, in 2021 Italy was where Spain was 3 years ahead and France 8 years ahead), it has begun

to scale the volume of this market. Below, in Figure 14 (King, 2022), is the valuation trend of all startups in the following countries funded by VCs:

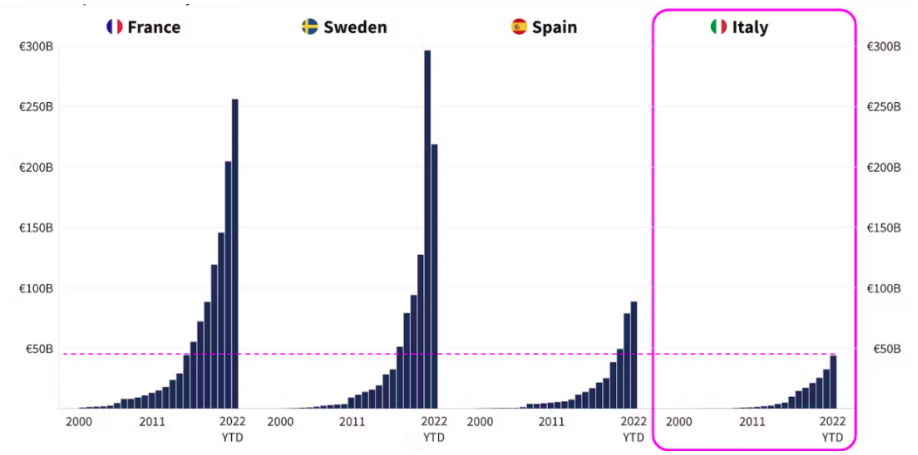


Figure 14: VCs market valuation trends in Europe

The year 2022 was a record year for startup investments in Italy, reaching a record 831 million in the third quarter, as depicted in Figure 15 (King, 2022):

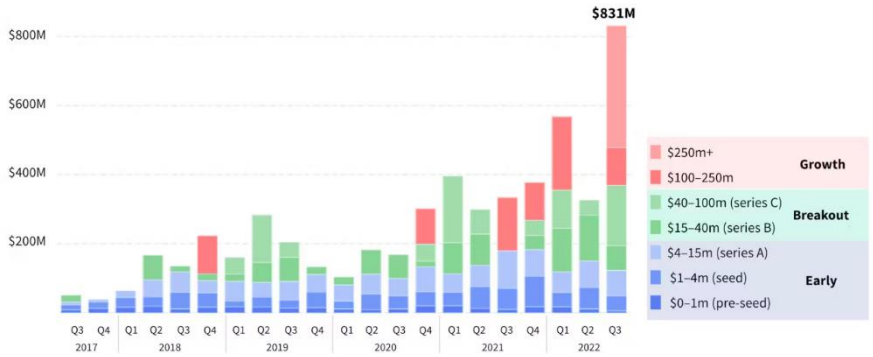


Figure 15:VC investments in Italian startups

The geographical and sectorial distribution of VCs targets are principally in Lombardy and Piedmont, with 61 and 16 targets, respectively, also lower than the 2022 number, i.e., 124 and 29 (VeM Venture Capital Monitor, 2023).

Italy still lags behind respect other European countries, such as Estonia and the UK that have VC funding per capita (dating back to the first quarter of 2022) of 750 and 300 euros respectively, while in Italy this amount is only 18 euro (King, 2022).

Private Equity

Private Equity are still funds but what differentiates them from Venture Capitals is that they invest in mature companies operating in traditional businesses, with a proven business model, and that are looking to expand and consolidate their business through mergers, acquisitions, management transitions, or other corporate transactions. Another difference lies in the size of the investment; while Venture Capitals can range from a few hundred thousand up to several tens of millions, they make investments of at least a few million up to hundreds of millions, using not only equity instruments but also debt. The use of debt, which is unusual for this world (leaving out debt crowdfunding) is possible because the risk for these businesses is significantly lower, which does not depend on the product fit, technological or scientific innovation or the behaviour of the customer, but on the meeting of debt obligations, the effective management of the business or the evolution of the market, as well as the stage and industry.

These funds can be sector agnostic or specialized, can target certain geographies or operate on a global scale and can be classified into two categories. Growth funds invest in mature companies that are expanding their operations and entering new markets. The main transactions that are done are mergers and acquisitions and are usually not sector specialized. Leverage Buyout funds (LBOs) target mature companies too, financing the transaction with a small amount of equity and a large amount of debt. Their goal is to maximize the value of the company, before it is resold, using restructuring techniques, cuts, partnerships or M&A. (Alemany, 2018)

Corporate Venture Capitals

Several large corporations are founding or allying with Venture Capitals, which are named Corporate Venture Capitals, such as the U.S.-based Google Ventures and Intel Capital or Europe's Santander and Siemens. In addition to the possible financial return, which is obtained from selling the shares of the company in which one invests, which, however, is not the main business of these large corporations; the main objective of these companies is strategic: these Corporate Venture Capitals are linked to the business development, innovation and strategy divisions of the corporations. In this way, these companies are able to keep abreast of the latest technological innovations landing on the market and, if they feel that the new product/service can bring value to their core business, acquire the company at a later date.

Certainly, for entrepreneurs, having such investors brings enormous benefits, such as huge amounts of financial resources and more, but there are also problems, as decisions that are made by corporations too quickly or too slowly could hurt the startup. Additionally, he presence of strategic investors may impede their ability to secure additional money from other VCs. This is due to concerns that a strategic investor sitting on the board could potentially impede future sales of the business to third parties, particularly if these third parties are competitors of the corporation, thereby blocking a potential exit strategy.

Bootstrapping

Within the context of entrepreneurial finance, the term "bootstrapping" pertains to the metaphorical notion of "pulling oneself up by one's own bootstraps" (White, 2022). This metaphor highlights the concept of achieving goals or overcoming challenges on their own without the help of others. It refers to the practice of providing financial support to a startup using personal finances and innovative financing methods, rather than depending on external investors or traditional forms of financing. The idea of bootstrapping places an emphasis on independence and the effective use of resources already at hand to expand a business (Patro, 2015). Among the various sources that can be used to finance the venture in this way are the entrepreneur's personal savings, sweat equity (i.e., physical labour, mental effort and time on the part of the entrepreneur), lean operations, quick inventory turnover and a cash runway.

Bootstrapping strategies are not all the same; the main ones are made explicit below:

- Personal equity: early in the life of the venture, when usually the capital needed is less than what will be needed in the future, such as during the scale-up phase, it may be the founder himself to contribute personal capital;
- Personal debt: in case the founder does not have sufficient wealth to invest in the startup, he can apply for a loan. Usually, however, it is not possible to attribute the loan directly to the startup because it does not have an established financial history like that of the founder and, often, not even assets, so a bank would hardly be willing to incur such a high risk. The disadvantage of this is that the entrepreneur becomes directly liable for the loan, increasing the financial risk he has to take on, with the risk that his personal assets could be seized if he fails to repay the loan;
- Cut and avoid costs: if cash income cannot be increased, one can act by limiting its expenditures, cutting costs. In addition to eliminating some expenses, one can also act on how things are done, reducing costs, if not eliminating them. This

results in a trade-off between capital and time, that is, instead of entrusting a task to a particular person in exchange for money, the entrepreneur can decide to do the task himself, but sacrificing his time;

- Limit business operations: what a venture can do to reduce costs is to limit the operations it performs, such as manufacture products only after a preorder, limit its presence only in certain geographic areas, or sell only certain types of products, which are less expensive to produce, and wait until later for those products that are more expensive to produce, even if more profitable;
- Delaying accounts payable and minimizing accounts receivable.

There are both positives of using this technique and negatives. The positives certainly include the fact that in this way the entrepreneur can maintain greater control of his startup, as he does not have to rely on investments from third parties and thus does not have to divest part of the company's equity. It can also lead to greater short-term profitability, as costs are lowered. On the other hand, among the downsides of this technique is that this may increase the financial risk and it may be the case that one does not have enough investment to make the startup a successful company at a reasonable rate, increasing the risk of failure of the venture, especially if a large and unpredictable spending arises. The entrepreneur also must make a trade-off between reinvesting the little financial resources that are generated in the business to grow it or paying back the investment made, to get a financial return. Another problem is that bootstrapping is not sustainable in the long run, as it increases financial risk more than necessary, so it should be used as a temporary solution until a better solution is found. (Meuleman P. M., 2022)

This is not to say that a company that starts its lifecycle using bootstrapping cannot scale-up and become a huge, international, and successful business; in fact, there are several examples that prove otherwise, of companies that had humble beginnings and bootstrapped starts but have become among the largest and most important companies on a global scale, such as GoPro, Facebook and Amazon.

Therefore, it is necessary that, before using this technique, the entrepreneur assess whether it makes sense, based on the business, to use Bootstrapping.

F&F

F&F in entrepreneurial finance stands for Family, Friends, Fans and Fools. These people are the ones who help the entrepreneur with investments in the early stage of the venture, so typically in

the pre-seed and seed stages. These people often invest in the venture not based on well-defined criteria regarding the business idea or financial prospects, as other types of professional investors do, but what makes them invest is the personal relationship with the founder, the trust and belief in him.

Family and friends are the initial sources of support and investment for the new firm, as they possess personal connections with its founder and have confidence in his capabilities. Fans are individuals who lack a direct personal connection with the entrepreneur but possess a strong enthusiasm for the idea and thus a desire to provide their support. Individuals referred to as "fools" are those who possess limited comprehension of the potential risks associated with investing in a novel enterprise, nevertheless exhibit unwavering resolve to proceed.

This particular form of financing is classified as an informal funding source due to its lack of involvement with conventional financial institutions. It can be extremely helpful for entrepreneurs, particularly during the earliest phases of the business cycle, as it is ideal for acquiring funds to develop the concept, fabricate prototypes and cover initial operational costs. In fact, F&F financing usually is more easily accessible than traditional funding sources, such as banks or VCs, because it is not based solely on strict financial criteria but on personal relationships and trust. In addition, there is also more flexibility for repayment of the investment, as investors are more understanding and supportive. It is also less expensive as there are lower, if not none, interest rates or fees. Finally, they are also faster to obtain, not wasting the entrepreneur's valuable time with very lengthy procedures. Despite the benefits, this type of funding also has problems, as conflicts of interest can be created, which can be aggravated in the case of family members and friends, and in case the venture goes wrong, one would go on to lose the investment made by friends and relatives. In addition to the risk of losing the investment of friends and relatives, it should also be emphasized that they can contribute only for a small part to the investment a business needs, so this source of funding is rather limited (otherwise the entrepreneur may have considerable difficulty in growing and scaling the business). Compared to other investors, such as VCs and BAs, who can provide far greater investments, F&Fs are usually not even able to help the business as they lack expertise and experience in the venture industry.

Public Sources of Funding

To develop the startup entrepreneurial ecosystem, in Europe, but also more generally in the world, there is an increasing presence of Governments and public bodies, which, through various policies and support programs, try to help entrepreneurs and develop innovation. This mindset follows the idea that is reported in Mariana Mazzucato's book, The Entrepreneurial State (Mazzucato, 2013), in which she questions the conventional wisdom about the role of the state in fostering innovation and economic growth. Mazzucato does not think that the state should only correct market inefficiencies, but should play an active role in directing innovation, without leaving this task to the private sector alone, encouraging innovation and entrepreneurship through financial investment in R&D, the backing of new sectors, and the creation of an atmosphere that is favourable to successful company operations. Many technologies have been developed through this approach, such as GPS, clean energy technologies, and some of the most important programs such as the Apollo program, the Manhattan Project, and the creation of the Internet, where the State (in this case the U.S. government) has directed all available forces, creating a common vision for all players (Mazzucato, 2013). The State, in order to stimulate innovation and investment in cutting-edge sectors, must take some of this risk itself, making financial investments, from which a social benefit will be generated, thus a social return, but also an economic return, which must benefit the public, and not only the private sector.

Therefore, given the great importance that governments and public bodies have in the development of innovation, this section discusses public support programs and sources of public funding, such as grants, loans, guarantees, limited partner and fund of funds.

Public Support Programmes

Public Support Programmes are entrepreneurial communities, consisting of a network of key players, such as public and private, local and international investors. In these environments, specific actions must be implemented that on the one hand stimulate entrepreneurs to be investment ready and on the other stimulate the supply of smart money to be invested. (Alemany, 2018)

On the supply side, in addition to financial tools such as public money, there are also mentoring and coaching activities. These activities on the supply side are not effective unless there is a developed demand side on the other side, so develop a well-connected ecosystem is essential.

An example, at the European level, of these initiatives there is Startup Europe, which aims to increase connections between players (not only European) to increase business opportunities to find investors, customers and partners. One of the current goals is to connect the European ecosystem with that of other continents, such as Silicon Valley (in the U.S.), India, Africa, Latin America, Eastern European Partnership and China. Other examples are Startup India, Canada Business or national cases such as in Spain and UK, where the former focuses on financial support, through non-refundable grants, co-investment with private investors and grants to hire staff, while the latter on taxation benefits, offering tax relief (from 30% to 50%) to investors who purchase shares in a startup. (Alemany, 2018)

Grants

Grants are typically used by governments in the early stages of business development and are usually part of a support program that may include mentoring and coaching. There are two types of grants. The first type is a direct fund given by public authorities as a non-refundable grant, so since the entrepreneur will not have to pay it back, the tricky part is figuring out who deserves this grant. To gloss over this problem, there are also grants that are given to those ventures that have already been able to raise a certain threshold of capital; this generally means that a private investor has deemed the business idea a good investment. Usually, the probability of obtaining this grant is directly proportional to the stage of technological evolution of the business. In the second type of funds, on the other hand, it is given in the form of a convertible grant; this means that if the business succeeds, it will have to be returned, according to certain criteria established at the time the grant is given, while if the business fails, it will not constitute a debt for the entrepreneur, since it is not deemed liable. The difficulty in giving this type of grant is figuring out which entrepreneurs are truly motivated in their idea, as they can be considered as interest-free loans for which one is not even liable. (Alemany, 2018)

Public Loans

Public loans refer to the financial obligations that are taken on by national, regional or local governments, as well as public entities like central banks or development companies, in order to fund various projects and enterprises. In contrast to grants, which often do not necessitate repayment, loans are financial resources that are borrowed and must be reimbursed with accrued interest within a predetermined timeframe. Typically, the interest rates exhibit a high degree of

favourability, accompanied by prolonged maturities and an initial grace period prior to repayment. Additionally, there exist subsidized loans, where the government assumes responsibility for repaying the interest, or part of it, thereby enhancing their appeal to entrepreneurs. The government does not always give the money directly but, in many cases, it guarantees (up to a certain threshold) loans made by banks and finance companies. In addition to the benefits that come with it, such as access to capital, low interest rates and government guarantee, there can also be difficulties, such as eligibility requirements, bureaucracy, and government controls.

Lately, a new type of loan has also been created, called public loan to investors, which is usually given to VC funds, with very competitive interest rates and grace periods, by certain banks called development banks. (Alemany, 2018)

For example, in Europe the European Investment Bank gives public loans starting at 25 million euros to public sector entities to finance a single large investment project or investment program, which is inherent to one or more of the European Investment Bank's priorities, which follows the Paris Agreement goals. (European Investment Bank, s.d.)

Guarantees

A government or public institution will financially back debt financing with a guarantee from a public support program. This indicates that in the event of a default, the government or public institution will pay back the loan or investment. The implementation of governmental support programs can potentially reduce the level of risk faced by investors and lenders, so facilitating the acquisition of financial resources for both enterprises and individuals. This may be particularly advantageous for small and medium-sized enterprises (SMEs) as well as innovative startups. The mobilization of funds that would not otherwise be forthcoming and the reduction of financing expenses are the two basic goals of guarantees.

An example of an institution that gives public guarantees is the European Investment Funds, which is a financial institution that gives support to new European ventures through equity, guarantees and microfinance, with the aim of stimulating economic growth and innovation. (EIF, s.d.)

Limited Partner

Another way to bring public capital into the entrepreneurial ecosystem is to make a public entity a limited partner in a VC fund or give funds to certain BAs. (Alemany, 2018)

Fund of Funds

The latest mechanism for bestowing public funds is the Fund of Funds, that is, a fund of funds where the government agency selects a private manager who will be responsible for selecting the VC funds to which public capital is poured, so that it is not the government itself that manages the fund, but professional management is assured. An example of this mechanism is the Pan-European Venture Capital Fund(s) of Funds Program. (Alemany, 2018)

Sources of debt

Debt sources that can be used include:

- Convertible Note;
- Personal debts incurred by entrepreneurs;
- Debts of family and friends;
- Bank loan.

Convertible Note

A convertible note refers to a type of financial instrument that possesses the capacity to be converted into equity at a later point in time, typically during a subsequent round of financing. Convertible notes are commonly employed in initial funding rounds in entrepreneurial finance when it is difficult to determine a company's value, deferring the valuation to a later time when the organization is more developed and thus more easily evaluated. The essential components of a convertible note generally encompass an interest rate, a specified maturity date and a conversion price, which represents the monetary value required to convert the note into equity. To incentivize investors to invest in the first phases of a business's growth, the conversion price is occasionally established at a lower value than the projected valuation of the company in the forthcoming

funding round. Convertible notes provide a higher degree of flexibility and can serve to bridge the gap between initial funding and subsequent financing rounds, rendering them an attractive financing option for both investors and entrepreneurs.

Personal debts incurred by entrepreneurs

Since startups are usually not secure businesses and do not possess collaterals, which are necessary to obtain a bank loan, it may be appropriate for the entrepreneur to take on personal debt. It is, in fact, a common practice, especially in the inception stages of the business. This method, compared to others, can be quick and flexible, but it also has very high risks. Among the advantages are certainly speed, flexibility, accessibility, given that it is accessible when other sources of financing are not, and control, since the entrepreneur does not lose control over his enterprise, as he does not have to give up equity stakes. Among the disadvantages, the first is definitely risk, since if the startup does not generate the forecasted profits or fails, the entrepreneur may find himself in financial difficulties, and costs, due to interest and fees.

Debts of family and friends

Family and friends (F&F), in addition to being able to participate through the purchase of equity, can assist the creation of the startup in the early stages through loans. Like personal debt incurred by the entrepreneur, this form of financing has as its strengths accessibility, given that it is usually accessible when other sources are not, speed in obtaining it, and flexibility, while among the disadvantages there is always risk, given that in case the startup goes wrong, money from friends and relatives will be lost, with a risk of damaging personal relationships.

Bank loan

Bank loans, although difficult for startups to obtain, can be very helpful for their development. They are difficult to obtain because the startup does not have a track record and often not even assets that can be mortgaged. However, if a startup is successful in obtaining a bank loan, the advantages are many: banks can give large sums of money (unlike F&F), loans can have lower interest rates than other forms of financing, such as risk capital, and a relationship with the bank can be built, which is useful for possible future financing. Disadvantages, however, include, as

mentioned above, difficulty in obtaining the loan, possible restrictions and conditions that may limit the startup's flexibility, and the debt may be difficult to repay if the startup does not go as forecasted.

Family Office

A Family Office is a private wealth management advisory firm that gives support to one or more ultra-high-net-worth families (differentiating into single-family or multi-family offices), not only with financial services, but also with various kinds of planning, charitable giving advice, concierge services, and other comprehensive services. The need to rely on a family office depends on the size of the family's wealth and its complexity to manage it. Usually those that give support to multiple families are more common, so they are less expensive, using economies of scale, and can give different services to different families; for example, while one client might require a family office to handle their lifestyle demands, while another would need to receive excellent support from a variety of professionals.

Giving support to these types of families would be impossible for any single advisor to do; in fact, a well-coordinated and collaborative team of experts in different areas, such as legal, insurance, investment, real estate, business, and tax, is required.

Fortunately, this presents startups with another funding opportunity to take advantage of. Family Offices also give the support they require because of their high levels of wealth and ability to tolerate longer investment periods. Such investments are probably advantageous for both the family offices (enabling them to generate greater profits) and the startups, giving them access to more resources and exposure. The entrepreneur needs to have a credible business strategy in place to attract family office investors. Additionally, one must be aware of the family office's investment preferences before approaching them. The proposed business plan must include directions on how to use the funds and how long they will be needed, as well as defined objectives and goals. If the family office is run by a powerful business family, founders should use this network of wealth holders not just for funding but also for business relationships. Their commercial wisdom and strategic leadership will undoubtedly aid startups in achieving global size. (SINGH, 2022)

1.3. Decision making

Since the goal of this thesis is to study whether startups that use the scientific method in decision making are more likely to obtain funding, after doing a comprehensive and in-depth analysis of the main methods of funding for startups, with their pros and cons, this chapter discusses decision making, its different approaches and integration with the scientific method.

Decision making that “is simply the process of making a choice” (McKinsey & Company, 2023) as in everyday life, but also in any company, so even in running startups, it is critically important, as decisions can have great impacts on its growth, efficiency, direction and success. These can be decisions about products, markets, hiring, investments and many other areas of crucial relevance.

As an aggravating factor, as mentioned earlier, in the entrepreneurial world there is the fact that decisions are made under conditions of uncertainty, with incomplete or, even, missing information, since the life of the startup has just begun, so there is no past historical data on which to base decisions.

Decisions then can be divided mainly into three types, according to their time frame and the size of their effect (Khalifa, 2021).

Strategic decisions refer to the choices made by individuals in senior roles within an organization that have a significant impact on the company's overall strategy and long-term objectives. They carry a significant degree of risk and uncertainty because to their reliance on future projections.

Tactical decisions are those decisions that link strategic and operational decisions, made by mid-level people and oriented toward the medium term. Risks, uncertainties and impacts are contained.

Operational decisions refer to the choices made by individuals at lower hierarchical levels that have a direct impact on the daily operations of a firm. These decisions are typically short-term in nature and carry little risks, uncertainties and consequences.

Decision making can follow several approaches. On the one hand there is the macro family of heuristic methods, and on the other hand there is decision making that is based on the scientific method, creating the branch called "Management Science".

Thus, this section discusses the main heuristic methods that are used in entrepreneurship. Then, the scientific method, the fundamental subject of the entire work, will be described, applied, then, to entrepreneurial decision making through "Management Science".

1.3.1. Heuristic methods

Heuristic decision-making methods refer to the mental shortcuts or "rules of thumb" that “helps people make decisions and judgements quickly without having to spend a lot of time researching and analysing information” (Dale, 2015), without trying “to optimize (i.e., find the best solution), but rather satisfice (i.e., find a good-enough solution)” (Gigerenzer, 2008). They expedite the decision-making process, but occasionally they introduce biases or mistakes. Here are are described a few popular categories of heuristic techniques.

“Trial-and-Error” entails attempting several solutions to an issue until the ideal one is discovered.

“Effectuation” is a heuristic approach to entrepreneurship that begins with the resources that are currently accessible and builds opportunities around them. Entrepreneurs use effectuation as a decision-making process when starting new businesses. It entails developing opportunities based on the resources that are now available. Early on in a new business, effectuation is a heuristic strategy used to control risk and uncertainty. (Sarasvathy, 2001)

“Verification Search” is another useful method. Entrepreneurs frequently highlight data that supports their theories so one of the heuristics used is verification search, which is confined to looking at examples where a specific result is known to have already happened or when a specific outcome is presumed to occur. (Dean A. Shepherd, 2011)

“Availability Heuristic” is used when individuals calculate the probability of an event by considering the ease with which past events or instances may be recalled. (Amos Tversky, 1973)

“Representativeness Heuristic” is used when rather of using actual statistical information, people estimate the likelihood or frequency of an event by evaluating how closely it matches their own prototype that have in mind of that event. (Kahneman, 1973)

“Anchoring (or Adjustment) Heuristic” is another possible method. In order to develop subsequent judgments, people heavily rely on an initial piece of information (the "anchor"). They may be able to move away from this anchor, but frequently not enough. (Tversky & Kahneman, 1974)

“Affect Heuristic” is used when individuals base their decisions on their sentiments or emotions at the time. (Paul Slovic, 2007)

“Familiarity Heuristic” stems from the availability heuristic and can be described as “judging events as more frequent or important because they are more familiar in memory" (Ashcraft, 2006). The familiarity heuristic employs schemas or previous behaviours as a scaffold for behaviour in a novel context. This is important since it saves time for the subject who is attempting to determine

the appropriate conduct for a previously encountered situation. Individuals expect that their previous behaviour will produce the same consequences in a comparable setting. This strategy is generally useful but certain acts may be improper when the situation changes.

“Escalation of Commitment (Sunk Cost Fallacy)” is used when, even when it's not in their best interests, people persist in a behaviour or activity because of the quantity of resources (money, time and effort) that they have already committed to. (Shapira, 1996)

“Recognition Heuristic” is another possible method. People often assume that the acknowledged alternative has a higher worth when there are two options and one is recognized while the other is not. (Todd & Gigerenzer, 2000)

“Simulation Heuristic” is, instead, used when people use their ability to mentally visualize or simulate an event to gauge its possibility. (Tversky D. K., 2013)

As already said, although heuristic techniques can be helpful in making decisions, they are also prone to a number of biases.

1.3.2. Scientific Method

The search for a method begins with the evolution of human thought. However, only in modern science it becomes essential, because without it humanity cannot expand its understanding of the world (TRECCANI, 2006).

The scientific method is a methodical approach to studying phenomena, learning new things and improving and expanding on prior knowledge. It serves as the cornerstone of contemporary science and is employed to create reproducible, objective and falsifiable world models. An essential component of the scientific method is "falsifiability". It implies that any theory or hypothesis that is put forward needs to be able to be proven wrong by observations or experiments. A statement is not deemed scientific if it cannot be verified or tested.

Its tremendous importance and efficiency has meant that this method is used in all sciences, from those defined as "hard", like the natural sciences that are often characterized by rigid experimental and mathematical methods and strong quantification, such as physics, chemistry, biology, astronomy, geology, mathematics, engineering and computer science, to the "soft" ones, then social sciences and humanities that may be less quantifiable, such as psychology, sociology, anthropology, economics, political science, natural sciences and education.

Since ancient times many civilizations have contributed in expanding mankind's scientific knowledge, from the Egyptians to the Babylonians, from the Greeks, who, with Aristotle, laid the foundations of formal logic, continuing with medieval scholasticism and Leonardo da Vinci. However, it can be argued that the scientific method, as it is understood today, dates back only to the 1600s, following the discoveries and thinking of some very important scholars: Copernicus, Brahe, Kepler, Galileo, Descartes and Newton (Betz, 2011). With their contribution, all the concepts that make up the scientific method came together, giving rise to it (Betz, 2011):

- “A scientific model that could be verified by observation” (Copernicus);
- “Precise instrumental observations to verify the model” (Brahe);
- “Theoretical analysis of experimental data” (Kepler);
- “Scientific laws generalized from experiment” (Galileo);
- “Mathematics to quantitatively express theoretical ideas” (Descartes and Newton);
- “Theoretical derivation of an experimentally verifiable model” (Newton).

Other contributions were also made by Kant and Einstein, up to Popper who, along with other philosophers, made a huge contribution to be able to apply this method to the humanities as well.

Popper's scientific method is based on the concept of "falsifiability", thus defined as "deductive". While the "inductive" method (thus based on verifiability) starts from a hypothesis and tries to prove it to be true through observations, Popper's method does the opposite process, i.e., it thinks that a theory cannot be proved to be true through one or more observations, as there could always be an observation that is not observed that would go against the proposed theory; to prove the truthfulness of a theory through inductivism it would require infinite proofs, which is objectively impossible. Thus, scientific theories, according to Popper, can only be disproved but not verified by empirical experiments. Thus, a theory can be considered "momentarily" verified if it holds up to comparison with experiments and at least more truthful than theories that have been proven false by experiments instead. So, according to Popper, a theory to be scientific must be expressed in a form that can be criticized and falsified on an objective level. (Popper, 1959)

So, the steps of the scientific method can be outlined in the following way (Wright, 2023):

- Make an observation or ask a question: the first step is to observe a phenomenon that is wanted to be understood or to formulate a question that is wanted to be answered;

- Gather background information: conducting research on the state of the art of a particular topic to see if anyone has asked the same question and whether they have already come to a conclusion;
- Form hypothesis: the hypothesis is a possible explanation of the phenomenon or a possible answer to the question being asked. If it were proved to be true, it would become a fact;
- Test the hypothesis: create a prediction that can be verified or disproved, based on the assumptions made earlier. It is essential that the test reports a measurable result that can be obtained through empirical analysis. In addition, other secondary variables that might influence the test result should also be considered and controlled, so that the final result on the variable being measured is not altered;
- Analyze the results of the test and draw conclusions: use metrics that have been defined beforehand to check whether the prediction is actually verified or not;
- Share the results or analyse new questions: share one's findings with the scientific world, to increase common knowledge, in case one's thesis is proven to be true; if not, one can think of new questions to answer and start the process over again from the beginning.

Some examples of the use of the scientific method to decision making in the world of entrepreneurial finance are discussed later, where, dealing with the InnoVenture Lab project, the topics of the 4 classes will be treated, focusing very much on the application of the scientific method.

1.4. Previous studies

The scientific method is already being used in managerial decision-making and entrepreneurship, going to constitute precisely the so called "Management Science", which is a field that helps diverse organizations handle complicated challenges and make better decisions by applying analytical techniques and mathematical modeling. It entails using quantitative approaches to streamline workflows, boost productivity and make wise decisions. (David R. Anderson, 2011)

Other than the work of Anderson, also the work of B. W. Taylor et al. (Taylor, 2013) is really important, who emphasize that this branch incorporates a scientific approach to solve management problems through the use of quantitative methods. Their work is geared toward providing the knowledge and tools needed to apply mathematical and statistical techniques to decision making in business.

Drucker's work as well (Drucker, 1955) seeks methodologies that can be used by the manager, transitioning from the notion of a scientific method and tools being applicable in the business world to the development of specifications for a Management Science that is better suited to the manager's requirements. This entails the creation of tools and techniques that are specifically tailored for managers, rather than being derived from pre-existing scientific tools.

The approach proposed by Eric Ries in his work "The Lean Startup" (Ries, 2011) (a "scientific approach to the creation of startups") revolutionizes the way startups conceive and develop their products and services, coming directly from the principles of the scientific method. To successfully navigate the uncertainty inherent in launching new ventures, entrepreneurs must adopt an iterative learning process based on hypothesis formulation, experimentation, measurement and adaptation. This "Build-Measure-Learn" cycle (which involves building a minimum viable product, called MVP, measuring its performance and feedback and learning from the data to make improvements or pivots), recalls the essence of the scientific method, where theories are continuously tested through experiments and the results are used to further refine hypotheses or to perform a "pivot", redirecting the venture in a new direction based on the feedback obtained. Through the implementation of this methodology, Ries not only provides entrepreneurs with a pragmatic tool to reduce risk and optimize resources, but also elevates entrepreneurship to an exercise in quasi-scientific inquiry, where discovery and innovation emerge not from solitary genius, but from the rigorous and systematic application of critical thinking and empirical analysis.

Like Ries, Alexander Osterwalder and Yves Pigneur employ a methodology that shares certain similarities with the scientific method. They utilize the Business Model Canvas to promote

innovation and develop business models. This involves observing the market and identifying unmet needs, formulating hypotheses about the business model, conducting experiments using the Business Model Canvas and analyzing feedback to either validate or modify the business model. (Osterwalder A., 2010)

Arnaldo Camuffo, Alessandro Cordova, Alfonso Gambardella e Chiara Spina, developed a framework to explore the implications of a method that was more scientific than those usually used in entrepreneurship, namely heuristic methods such as trial and error, effectuation and confirmatory search, the definitions of which, although already mentioned above, are discussed in more detail in Table 4:

Heuristic methods	**Definitions**
Trial-and-Error	In an iterative approach, various solutions are tested until one is discovered that is effective. It is a practical strategy that is frequently applied when an issue lacks a clear solution or exact formula. Entrepreneurs may try various goods, marketing plans or business models in the business world before settling on the one that sells the most
Effectuation	A method of entrepreneurship called effectuation was put out by professor Saras Sarasvathy. It is predicated on the notion that entrepreneurs should develop a firm from the ground up using the resources, talents and connections they already have available to them rather than starting with a preconceived market aim and looking for resources to achieve it. Starting with what is available, accepting losses (rather than projected profits), partnership construction and opportunity creation, rather than prediction, are the four major concepts of effectuation. It is a particularly helpful strategy in circumstances with a lot of uncertainty, like when starting a new business
Verification Search	This strategy involves an entrepreneur actively looking for support or validation of a certain idea or hypothesis. Confirmatory search concentrates on gathering information or feedback that supports a specific path or choice rather than investigating a broad range of options (as in a trial-and-error strategy). This can entail, for instance, performing market research to confirm interest in a new product or testing a particular marketing campaign to see if it connects with a target audience

Table 4: Heuristic methods

This study employed a randomized control trial experiment to compare the performance of 116 Italian startups that got training in the scientific decision-making method to those who did not. According to its findings, startup performance can be greatly impacted by taking a scientific approach, that includes prediction, rigorous testing and hypothesis validation, to entrepreneurial decision-making. By thoroughly testing their theories and making data-driven judgments, entrepreneurs who act like scientists are more likely to pivot or abandon unprofitable projects early on, increasing their total success rate. (Arnaldo Camuffo, 2019)

Felin and Zenger offer a view that holds that innovation and strategic success in the corporate world are directly related to the scientific process, which is defined by the formulation of hypotheses, experimentation and ongoing adaptation based on learning. The authors contend that increased creativity, innovation and eventually lasting competitive advantage can result from approaching strategic decision-making with a methodology similar to the scientific method. (Felin & Zenger, 2017)

Many studies have also been conducted to determine what stage of business development is most advantageous (leading to better performance) for entrepreneurs to apply the scientific method. These studies have demonstrated that entrepreneurs gain an advantage when their firm strategy has already been solidified and are less likely to make drastic changes. (Elena Novelli, 2021)

The process characterized by hypotheses, experiments, observation of results and their revision is also referred to as crucial in entrepreneurship by Kerr, Nanda and Rhodes-Kropf (William R. Kerr, 2014). This approach enables entrepreneurs and investors to navigate uncertainty, validate value propositions and adapt business models based on market feedback and data collected during the experimental phase. The analysis emphasizes that, just as in scientific research, experimentation in entrepreneurship requires an environment that tolerates failure and supports rapid iterations for the evolution of innovative ideas, demonstrating how methodologies based on the scientific method can be applied effectively even in the dynamic and uncertain environment of entrepreneurship. (William R. Kerr, 2014)

Through the lens of pragmatism, Thomas Zellweger and Todd Zenger (Thomas Zellweger, 2021) investigate the similarities between entrepreneurial activity and the scientific method. They contend that in order to systematically cope with the inherent uncertainty in entrepreneurial activity, entrepreneurs, like scientists, go through a process of training, testing and responding to hypotheses regarding market prospects. The authors describe how entrepreneurs develop ideas or beliefs to address market issues, test these theories through experiments and learn gradually, modifying their strategies based on the outcomes, using an approach rooted in pragmatism and cognitive psychology. (Thomas Zellweger, 2021)

Neither this study nor the previous ones have shown whether startups that adopt the scientific method in their decision-making process gain an advantage, resulting in "better startups" in the eyes of investors, in raising capital, which, therefore, will be the focus of this thesis.

2. Theoretical framework

The theoretical framework is the structure that support a theory of a research study. The narrative explanation of how the researcher uses the theory and its underlying assumptions to study the research problem is included in this part of the work.

2.1. Objective of the work

The goal of this thesis, therefore, is to take the next step beyond what has been done so far: understand whether the use of the scientific method brings a distinct advantage to the raising of capital by startups and businesses that use it.

For this reason, the following research question was formulated:

Research Question (RQ): startups that use the scientific method to make decisions are more likely to get funding from investors?

2.2. Hypothesis

In this section, therefore, the hypothesis to be tested in this thesis is formulated.

As discussed previously, using the scientific method to make decisions in entrepreneurship can bring several benefits.

The risk in these startups may be lower while the value and productivity are higher because these startups have done several tests and deepened the risks associated with the business. (Ries, 2011) (David R. Anderson, 2011) (Taylor, 2013)

The scientific method, with its emphasis on hypotheses, experiments and iteration, provides a rigorous framework for innovation and decision-making based on quantitative data, so these startups are more credible, because it can be demonstrated to investors the solidity of the choices made, not based on intuition and assumptions. (Drucker, 1955) (Ries, 2011)

They show better performance, suggesting that this approach may increase attractiveness in the eyes of investors, who are looking for projects with a solid validation base and a minor risk of failure. (Arnaldo Camuffo, 2019)

While heuristic methods such as trial-and-error and effectuation have their role, the adoption of the scientific method offers a more structured and measurable approach to the problem of innovation and business development, potentially leading to more predictable and attractive outcomes for investors. (Arnaldo Camuffo, 2019)

Using this method greater awareness of the target market and customers is made. (Ries, 2011)

They have more traction because they are able to get it through channels that are better identified through experimentation. (Gabriel Weinberg, 2014)

Have increased creativity, innovation and lasting competitive advantage. (Felin & Zenger, 2017)

Therefore, the following hypothesis was formulated:

Hypothesis: startups that use the scientific method to make decisions have a higher probability to get funding from investors.

3. Methodology

This section explains the methodological approach on which the thesis is based. Since this work starts from a project organized by three Italian universities, it also describes the project itself, the startups and investors who took part in it, and then the approach for data collection and its analysis.

3.1. InnoVenture Lab

InnoVenture Lab is a scale-up program organized by Politecnico di Torino, Politecnico di Milano and ICRIOS Centre Bocconi, bringing together their excellence in academia, their complementary expertise and their instructors' long experience in the startup world.

What was offered was a program by which useful methods and tools were transferred for financial planning, investor and capital search, which are essential to start a business and grow it.

The program was not open to just any type of startup, but the target audience was well defined: startups that could take part in the program had to have a validated business idea and be in the process of designing their financial strategy to support growth, without yet having any external investor.

This project had limited places and, being a project funded by the Ministry of Education, was completely free for all participants, who, unlike other accelerators, were not required to pay any equity investment or participation fees. These projects, called PRIN, which stands for "Progetti di Ricerca di Rilevante Interesse Nazionale", are administered by the Ministero dell'Università e della Ricerca (MUR) that fund those high quality projects that can be very complex and expensive, so they need experts from different universities and resources that would be unlikely employed by a single institution. They are open to all scientific fields, so natural, humanities, social and applied sciences, and must be submitted by research teams consisting of at least three researchers, one of whom must be an associate or research associate professor. They are then evaluated by a panel of international experts and, if funded, receive one million euros over three years, helping basic research and the national scientific system. (MIUR, 2015)

Participants learnt or refreshed their knowledge of the fundamental business concepts during the four online sessions that took place in April 2022. These sessions helped participants develop their managerial skills with the assistance of the instructors and could help their startups grow and draw the interest of outside investors.

Through in-class discussions and focused activities, the training program gave participants validated approaches to identify growth trajectories and boost the likelihood of attracting external investments.

3.2. Randomized Controlled Trial (RCT)

Before talking in detail about the specific project, it is good to cover the method that was used to carry out the study done in this project, namely the Randomized Controlled Trial method, on which it is possible to get more information from "Running randomized controlled trials in Innovation, Entrepreneurship and Growth: an introductory guide", by Nesta and Innovation Growth Lab. (NESTA, 2016)

RCTs are experiments in which the study sample is divided into 2 or more groups. One of them, the "treated" group, is given treatment, while the other group is not, the so-called control group. This second group is used to understand the effect of treatment compared with the case where nothing had changed. It is important that the association of the participants in the experiment to the two groups is totally random, to not influence the result of the study (e.g., eliminating selection bias), a result that is obtained by going to test both groups and measuring their difference; a difference that, in case the two groups are sufficiently large, is due to the treatment given, which therefore has a causal effect on the variable measured, and is not due, instead, to some other factor.

Those entities that can participate in these studies can be people, as in medical practices, but also businesses, startups teams and business incubators, commonly called "participants".

These studies can take many forms, but an example might be as shown in Figure 16, where a population taking part in the experiment is divided into two groups. Before the random division, it is possible to measure the study variable by doing a Baseline Survey. After this is done, the participants are distributed to the two groups, completely randomly. The intervention is imparted to the study group and finally the difference in the study measure between the treatment group and the control group is calculated. It is also important to keep under control all those variables that may influence the outcome, to be sure that the difference in the outcome is actually due to the treatment.

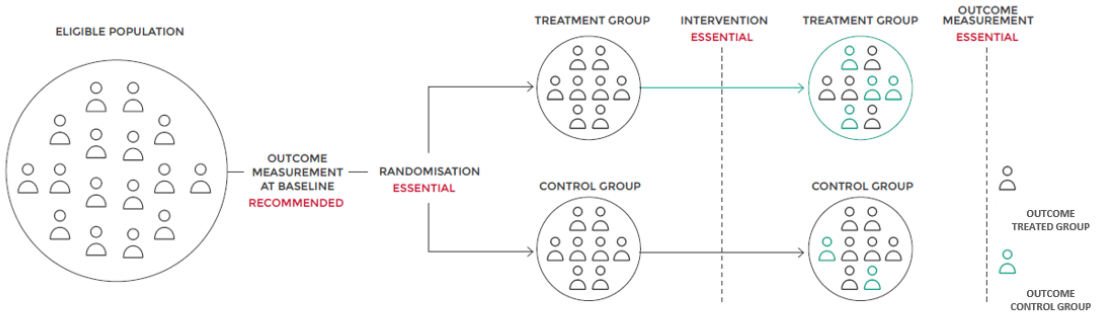


Figure 16: Randomized Controlled Trial methodology

All activities that are carried out in one of these experiments must be guided by a "protocol", a document in which the objectives, design and methodology of the experiment are expressed, such as participant selection, randomization and data management and analysis.

This methodology has its pros, such as eliminating some biases and errors that might invalidate a scientific study, but also its cons, such as other types of bias, applicability/economic and ethical problems. For example, one criticism that is often made of this methodology is the lack of generalizability, that is, the inability that the teaching obtained can be applied in other contexts as well, since the intervention might have had an effect only on that type of population, while on another it might not. Another problem is that RCTs show whether something works, and how well, but they do not explain why, which is left to the interpretation of the researcher. There are challenges related to sample and timeline, because there is not only the problem of being able to collect a sufficiently large sample to conduct an experiment (which while for certain phenomena is not difficult, in the world of business, entrepreneurship and finance it could be more) but also the time to reach this adequate sample and get the expected outcome could be quite long. In addition, some participants might also leave the program prematurely, with the causal loss of information. There are also ethical problems, since in some cases it is not possible to prohibit a group from administering the treatment.

This method should be used in those cases where the treatment is simple, linear and well-defined, whereas if it is complex and multi-layered it may not be the best approach. Consideration should also be given to the geographic scale on which the experiment is done, how easy and the stage at which the treatment is administered. To understand whether this method can be used, a feasibility study should be conducted beforehand.

The key element of this method is precisely randomization. There are several types, each with some strengths but also weaknesses. Simple randomization can be used, which involves randomly

assigning participants to the two groups, using, for example, a coin or software. While this is very simple to perform, it can be problematic for very small samples as it could create two unbalanced groups; to eliminate this problem blocked randomization can be used, which helps to create groups of similar size but increases the risk that the allocation process may be predictable. In contrast, stratified randomization divides the entire population according to one or more characteristics that may affect the outcome; in this way, groups that have these characteristics as similar as possible are obtained, to reduce their effect on the outcome and to isolate the effect due to treatment. This method is very attractive to use when there is a small sample and there is a risk that a large proportion of participants with a characteristic that influences the study variable may all flow into the same group, skewing the outcome, whereas it is difficult to use if participants are stratified by several factors.

With matched randomization, matches are created between participants (pairs if there are only two groups, triplets if there are three groups, and so on) such that these matches collect those participants who are most similar to each other; then allocating the participants from these matches to the different groups randomly will result in groups with similar characteristics to each other. This method has the advantage of creating well-balanced groups but also several challenges, such as loss of statistical flexibility and problems if a participant leaves the project.

Pair randomization simply creates pairs of participants and then randomly sorts them into the two groups, ensuring only numerical balance at the cost of an impossibility of stratification, loss of statistical flexibility and problems if participants drop out.

Finally, minimization, which is not really a random allocation method, since it is only at the beginning but then, when other participants join the project, they are assigned, one by one, to a specific group in such a way as to make the two groups more homogeneous, from the point of view of the participants' characteristics. This can ensure that the groups are balanced, while not being a random process.

Usually what should be randomized are individuals, but this is not always possible as this could lead to contamination in the control group by the treatment group or vice versa (this phenomenon is known as the "spill-over effect"); therefore, groups of individuals or clusters are often randomized.

To avoid any skewing of results, it is also important that researchers do not know which participants are part of which group until the trial has been completed, as they may alter the randomization to try to prove that their theory works. The same goes for participants who should not know whether they are part of the treatment or control group.

Usually, if there are no constraints, researchers divide the participants into groups of similar size; in fact, fixed the sample size, an equal allocation is better for statistical power. On the other hand, if there were problems with the number of participants to whom the treatment can be offered (e.g. resource constraints, such as cost or availability of the staff conducting the experiment), researchers can also opt for unequal allocation, being able to increase the sample size.

The complete process for carrying out this study consists of three phases, each divided into three additional stages:

1. Planning and design stage:
    a. Research question;
    b. Trial design;
    c. Pre-implementation preparation.
2. Implementation stage:
    a. Recruitment;
    b. Randomisation;
    c. Outcome data collection.
3. Analysis and reporting stage:
    a. Analysis;
    b. Reporting the RCT;
    c. Data management and storage.

If a particular phenomenon has not yet been explored in the literature it can be investigated, but this method should be used only for research questions that measure impact. So, the first step is to focus energies on a main, well-defined and formulated research question, but some other secondary questions are also possible. The next step is to clearly define the trial design used, who are the participants who can take part in the project (making sure that the sample is large enough), and what treatments and outcomes are being measured, differentiating them, if any, into primary and secondary, and carry out randomization. The third step is to register the trial, develop a detailed trial protocol and consider the ethical implications, as it is not always fair and possible to give the treatment only to one group. The implementation phase follows the instructions of the previously formed protocol. Participant recruitment is then carried out, which can also result in "initial" data collection of the outcome prior to randomization (called "baseline"), although this is not a requirement and sometimes not recommended. Then randomization takes place, immediately after eligibility checks are completed. Finally, after the treatment, data are collected from all groups at the same time and under the same conditions. For example, if the outcome is a score, the person who gives the score to the various participants should not be able to know which

group they belong to, to not be influenced. The last stage begins with data analysis, as defined in the protocol. Then reporting the RCT is done, in a transparent way so that others can assess the quality of the experiment and, finally, data management and storage is done, also in a transparent way, such as making the initial data available so that they can be used in future studies.

3.3. InnoVenture Lab itinerary

The InnoVenture Lab project consisted of seven main phases, each broken down into more detailed stages: startup selection, application data collection, interview 1 (baseline), lesson preparation, lessons, follow-up interviews (round 2 through 5) and demo day.

The startup selection phase, which occurred in late 2021, began with the creation of the website with which it was possible collecting applications (BEF: https://bef-research.com/), marketing the pathway and making contacts with incubators, startups that participated in a previous project (organized by the same universities), others from the “Registro imprese” and other external entities, via LinkedIn and standard emails.

The application collection phase took place in early 2022, in January, with the creation of the baseline survey, using the Qualtrics Survey, and its delivery; this enabled interested entrepreneurs to enter their startup data, before March 27, 2022.

Interview 1 (baseline) phase, consisted of the creation of an interview script, training of research assistants and interview delivery, carried out in April 2022.

Then the four classes were prepared, thus the creation of the slides, identification and contact with the instructors and their training, identification and contact with the guest speakers and randomization for the creation of the "Treatment" and "Control" classes, since while providing the training (which was the same for both classes), one of the two classes was also taught the so-called "scientific method”. A guest investor or successful entrepreneur were also invited to each class.

The classes were then held, between May and June 2022. They were instructed treatment startups first and control startups the following day.

Subsequent interviews (from 2 through 5) were then conducted in July, September 2022 and January and March 2023, respectively. In order to incentivize startups to stay in the program and continue with the journey, certain incentives were given, such as being able to submit the video pitch after the second interview, having the possibility to upload it on the BEF website after the third and being selectable for demo day after the fourth.

Finally, the demo day was held on April 5, 2023, which was attended by 36 of the 154 startups after they were selected based on their pitch by the project team. Entrepreneurs who took part in the event pitched in front of a panel of investors.

The entire program, divided into the seven macro phases, is shown in a simplified way in Figure 17:

Figure 17: InnoVenture Lab Gantt chart

3.4. The startups

This section describes the startups that took part in the project.

A total of 154 startups took part in the project, with a validated business idea and being in the process of designing their financial strategy to support growth, without having any external investors yet. Half of them, in addition to training to improve their knowledge to attract funders, were also taught to apply the "scientific method", with the idea that it will be useful in this process.

The only distinction is that they do not instruct the controlled group on how to frame a problem by developing a theory, how to generate hypothesis, how to test them through rigorous experiments using accurate and reliable metrics and how to define thresholds for these metrics to make judgments. They instruct and encourage the treated startups to gather this data, identify the issue and describe the problem during all four of their training phases so that they may develop a framework and create testable and falsifiable hypotheses.

As can be seen from Figure 18, most startups are made up of 1 entrepreneur, 2 or 3, with 27%, 28% and 22%, respectively, while the remaining 23% are made up of teams of more than 3 people, with a maximum of 11 and an average of 2.66:

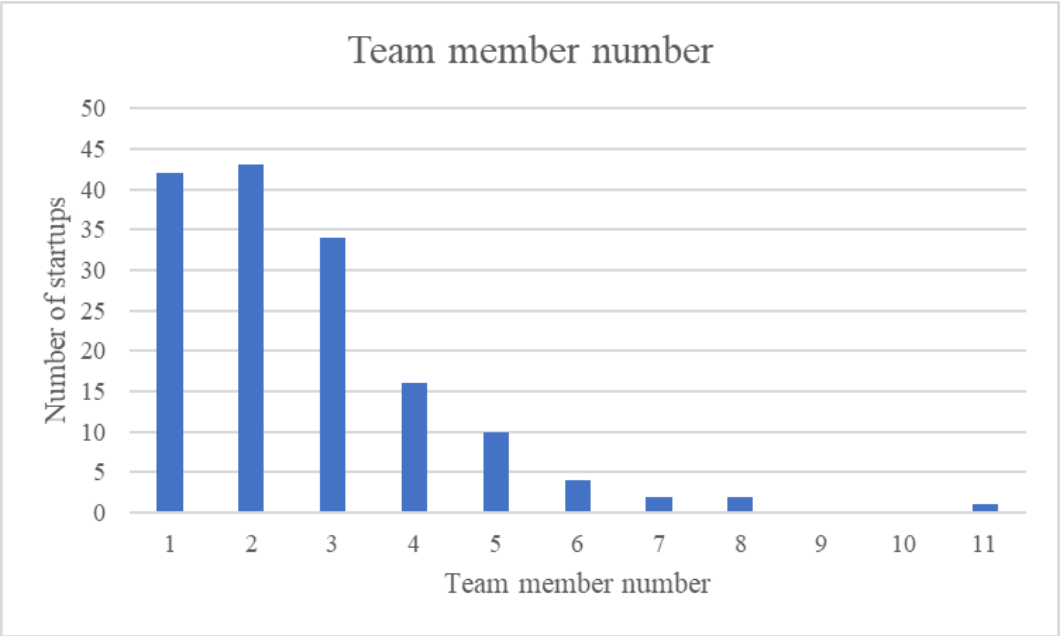


Figure 18: Team member number

The number of employees, on the other hand, is much lower, averaging just over 1 per startup, as depicted in Figure 19, where the most common case is startups that have no employees, but only partners, that is 64% of cases, followed by startups that have from 1 to 3 employees, in 28% of cases. Generally, there are no more than 8 employees, apart from one case that has 30:

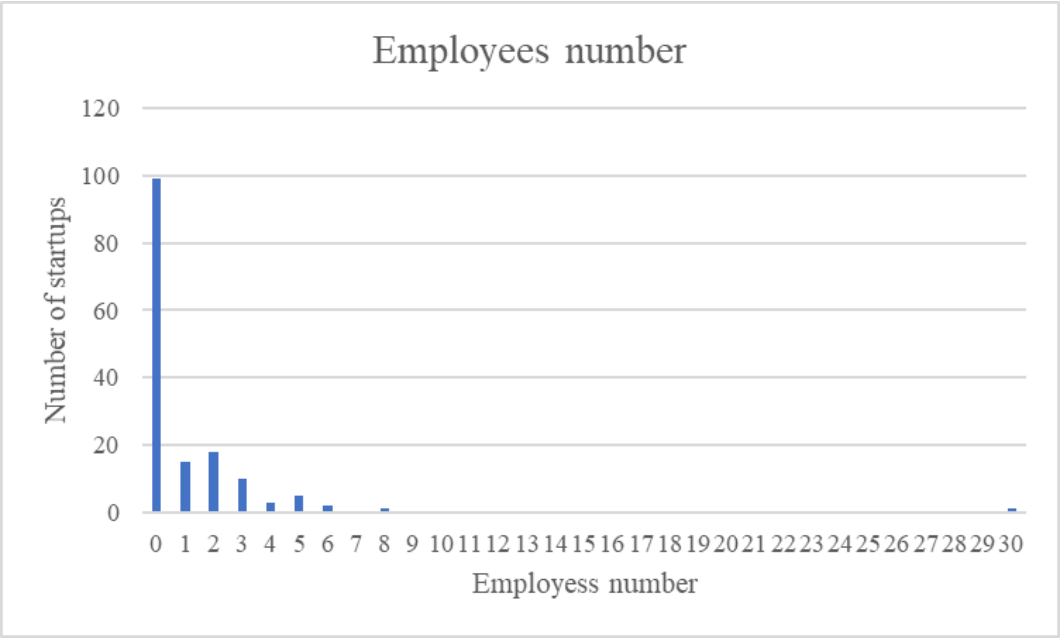
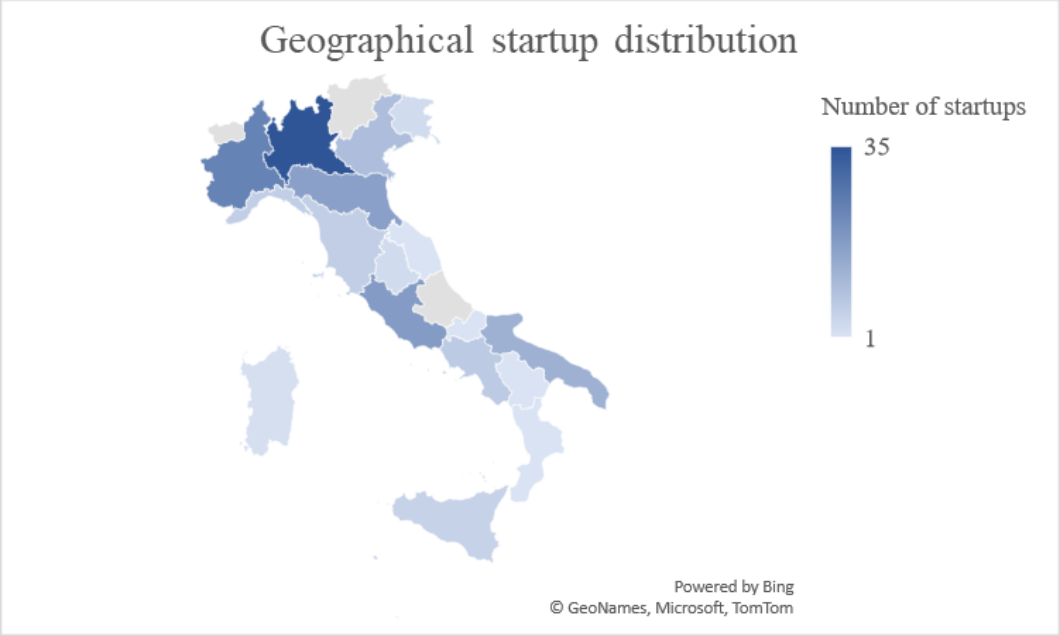


Figure 19: Employees number

Instead, the geographical distribution of startups is shown in Figure 20. Apart from a single case, which is based in Spain, most of them are concentrated in the region of Lombardy, which, with 35 startups, is close to a quarter of the total number of startups, followed then by Piedmont, Lazio and Emilia Romagna. Strikingly, 62% of the startups are concentrated in the north of the country.



Startups by region																	
Sardegna	Piemonte	Lombardia	Umbria	Puglia	Emilia-Romagna	Sicilia	Lazio	Liguria	Toscana	Campania	Marche	Veneto	Friuli-Venezia Giulia	Calabria	Molise	Basilicata
2	24	35	3	13	17	5	18	6	6	7	1	10	3	1	1	1

Figure 20: Geographical startup distribution

Next, again for the startup anagraphy, the distribution of the startups' founding year is shown in Figure 21. The oldest startup was born more than a decade ago, while most of them (more than 42%) are one year old. It is normal for most startups to be short-lived since, if they were not, they would not be considered startups, many startups fail after a few years of life and the project has been able to be joined by those startups that are still in a fairly early stage. In addition, startups that have been born for less than 5 years (so they could be innovative startups, if other characteristics are also met), are 126, the 82% of them.

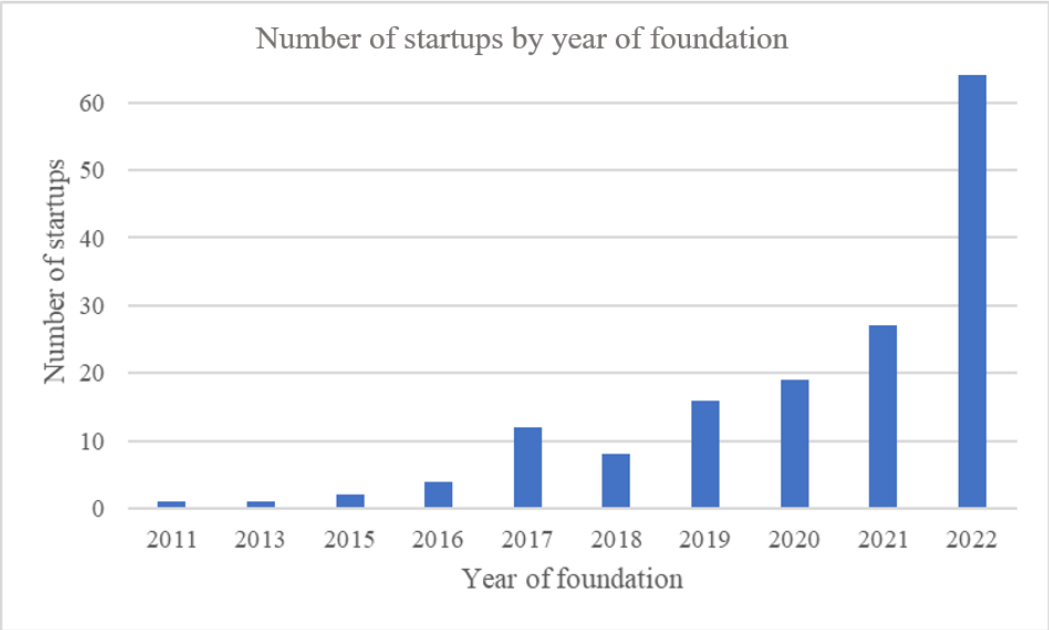


Figure 21: Number of startups by year of foundation

In Figure 22 there is the legal form of startups, indicating whether they are SRL (LLCs) or other types.

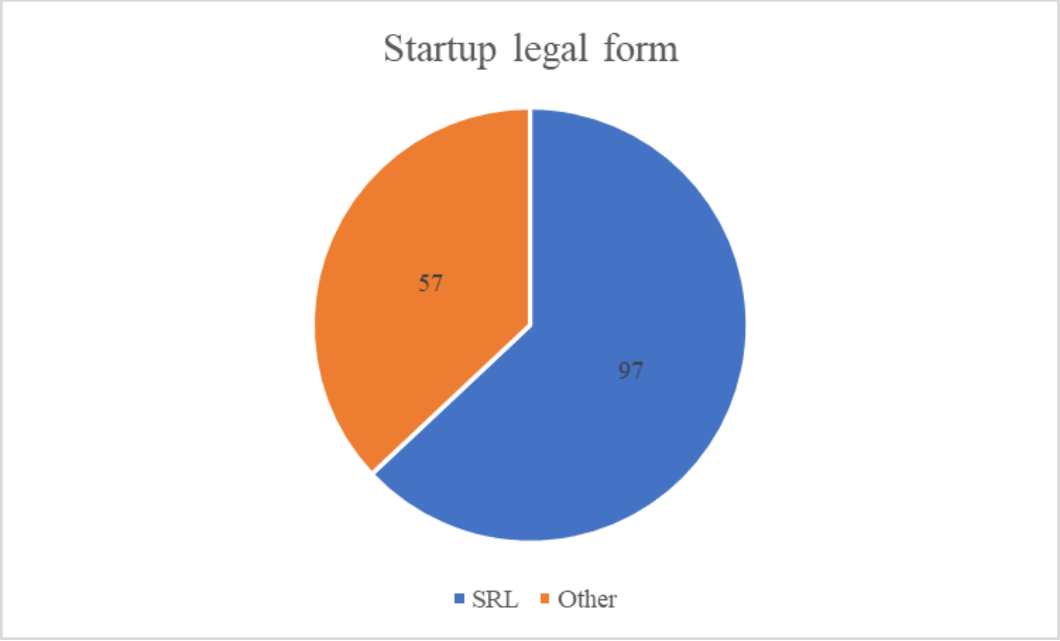


Figure 22: Startup legal form

Three-quarters of the startups in the sample offer services, while the remaining one-quarter develop products.

Finally, regarding the industry in which they operate, ATECO codes were used to categorize the startups. There is a wide variety of industries in which they operate, counting 36, but the most relevant are "62.01 - Non-edition-related software production" with 48 startups (almost one-third), "72.19.09 - Research and experimental development in other natural sciences and engineering," with 23 startups, and "63.12 - Web portals" with 20 startups.

It was also studied how many of these startups are innovative startups. This was done by searching the business registry by their tax ID number. Since at the time of their registration in the program some of them may not yet have entered in that registry (so they did not have a tax ID number), the number of innovative startups, 111 and 72% of the total, could be even higher, if in the process some of them registered.

Instead, the Figure 23 shows what stage of development the various startups are in, i.e., whether they are still identifying customer needs, whether they are or have tested the value proposition, whether they have a minimum viable product, whether they have started product/service industrialization or whether they have consolidated their presence in the market.

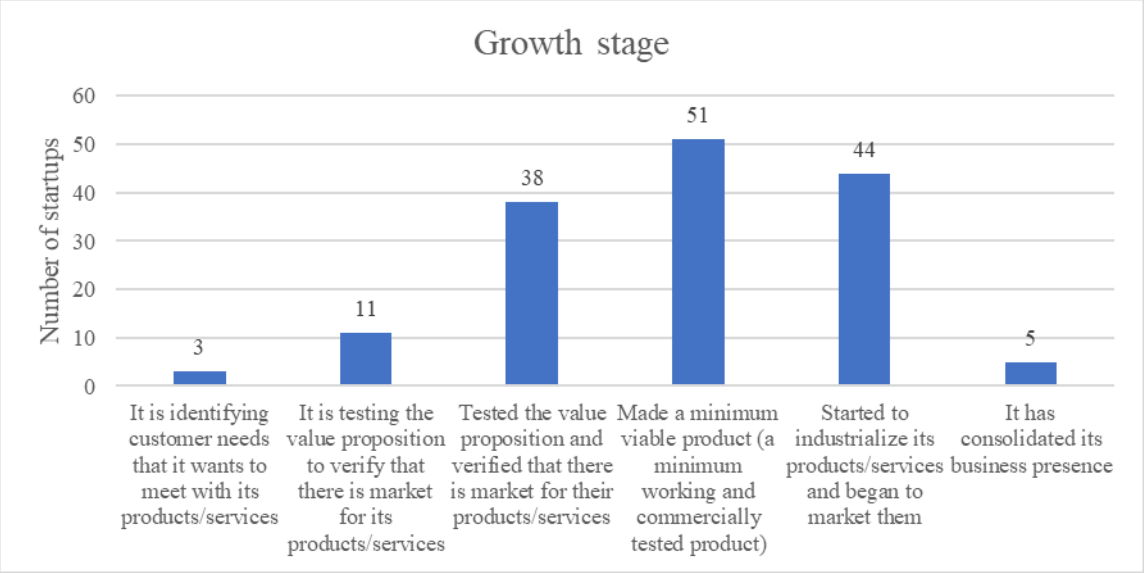


Figure 23: Growth stage

3.4.1. The entrepreneurial teams

In addition to gathering information regarding startups, information was also collected regarding the entrepreneurial team, an element of no small importance when the subject of discussion is startup success and obtaining funding.

In terms of the gender of the entrepreneurs who took part in the project, there is a clear disparity between the two sexes, as out of a total of 409 entrepreneurs, 333 are men, while only 76 are women, with percentages of 81.42% versus 18.58%, respectively. On the other hand, as for startups with at least one woman within the entrepreneurial team, the percentage stands at 36.36%. More interesting, however, is the figure regarding female dominated startups. The correct definition of female dominated startups is "companies whose participation of women, calculated by averaging the shares of ownership and directorships held, is more than 50% overall" (Urso, 2022). Since the distribution of ownership shares was not available, it was seen the number of male and female entrepreneurs within the startups and calculated their ratio. The female presence within startups can be seen from Figure 24, which shows that most startups are male dominated. There are 27 female dominated startups, accounting for 17.53% of the total, much higher than the national average of 3.4% (Urso, 2022), while male dominated startups number is 127 (82.47 %). While startups established solely and exclusively by female entrepreneurs are 12 (7.79%), those established solely by male entrepreneurs are 99 (64.29%).

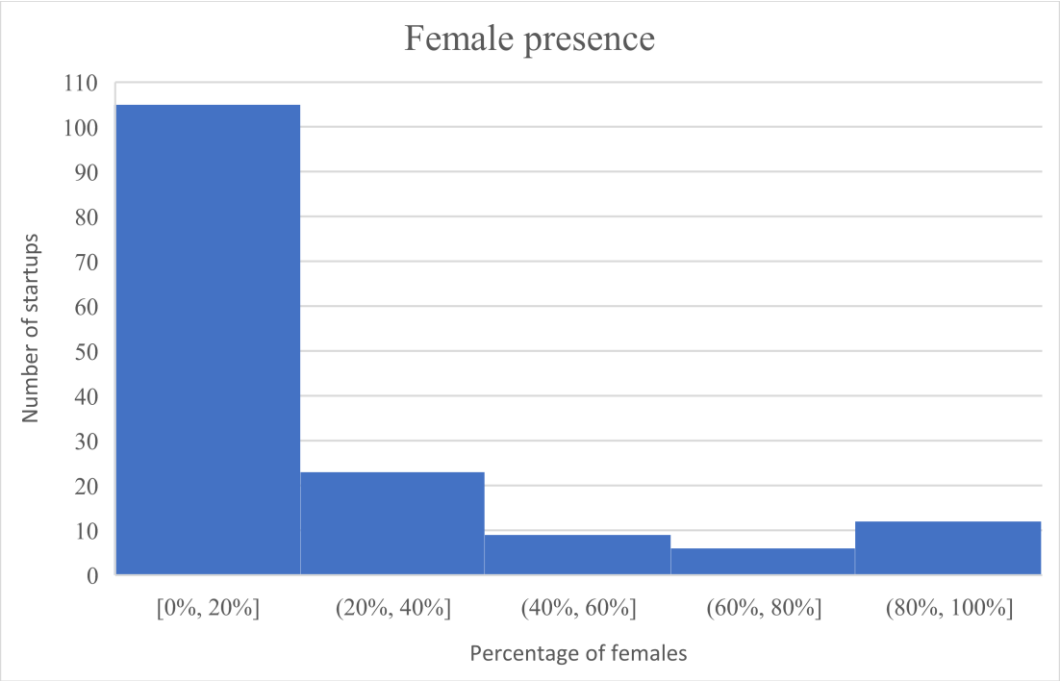


Figure 24: Female presence

Information was also collected on whether entrepreneurs were doing other activities in addition to being part of the startup, such as another job or a course of study. Two-thirds of them are doing an additional activity, exactly 68.22%; 7.58% are pursuing a course of study, while 64.79% are

working in addition to running the startup. Only 1.71% of entrepreneurs both work and study in addition to being part of the startup.

Regarding their educational background, 300 of them (73.35%) hold a bachelor's degree, 221 of them (54.03%) a master's degree, 103 of them (25.18%) have a postgraduate degree and 39 (9.54%) a PhD. Below are tables showing the number of entrepreneurs who have obtained a certain university degree and the relative percentages calculated out of the total number of entrepreneurs who have acquired that degree (Tables 5, 6, 7 and 8):

Bachelor degree type	**Number of entrepreneurs**	**Percentage**
Engineering	94	31.65%
Economics and Management	66	22.22%
Political and Social Sciences	23	7.74%
Medicine, Biology, Agricultural or Veterinary Sciences	23	7.74%
Chemistry, Physics, Mathematics or Statistics	23	7.74%
Architecture or Design	18	6.06%
Historical, Philosophical, Educational or Psychological Sciences	12	4.04%
Computer Science	10	3.37%
Law and Jurisprudence	10	3.37%
Other	9	3.03%
Languages and Literature	8	2.69%
Sports Science	1	0.34%

Table 5: Bachelor degree type

Master degree type	**Number of entrepreneurs**	**Percentage**
Engineering	67	30.59%
Economics and Management	58	26.48%
Chemistry, Physics, Mathematics or Statistics	22	10.05%

Medicine, Biology, Agricultural or Veterinary Sciences	18	8.22%
Computer Science	11	5.02%
Architecture or Design	11	5.02%
Political and Social Sciences	9	4.11%
Historical, Philosophical, Educational or Psychological Sciences	9	4.11%
Law and Jurisprudence	7	3.20%
Other	4	1.83%
Languages and Literature	3	1.37%

Table 6: Master degree type

Post lauream type	**Number of entrepreneurs**	**Percentage**
Economics and Management	69	66.35%
Medicine, Biology, Agricultural or Veterinary Sciences	6	5.77%
Engineering	6	5.77%
Computer Science	5	4.81%
Architecture or Design	5	4.81%
Political and Social Sciences	4	3.85%
Historical, Philosophical, Educational or Psychological Sciences	3	2.88%
Law and Jurisprudence	3	2.88%
Other	2	1.92%
Chemistry, Physics, Mathematics or Statistics	1	0.96%

Table 7: Post lauream type

PhD type	**Number of entrepreneurs**	**Percentage**

Engineering	12	31.58%
Chemistry, Physics, Mathematics or Statistics	10	26.32%
Computer Science	4	10.53%
Economics and Management	3	7.89%
Medicine, Biology, Agricultural or Veterinary Sciences	3	7.89%
Historical, Philosophical, Educational or Psychological Sciences	2	5.26%
Political and Social Sciences	2	5.26%
Architecture or Design	1	2.63%
Law and Jurisprudence	1	2.63%

Table 8: PhD type

Thus, 28.61% of entrepreneurs possess skills that can be described as "tech" (i.e., 117 of them).

Data were also collected on their experience in the world of work and in their industry (Figures 25 and 26):

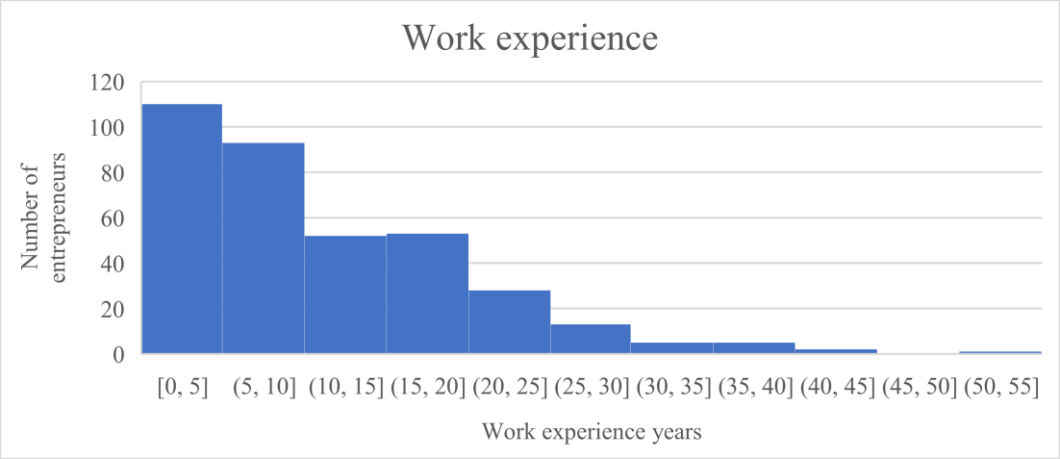


Figure 25: Work experience

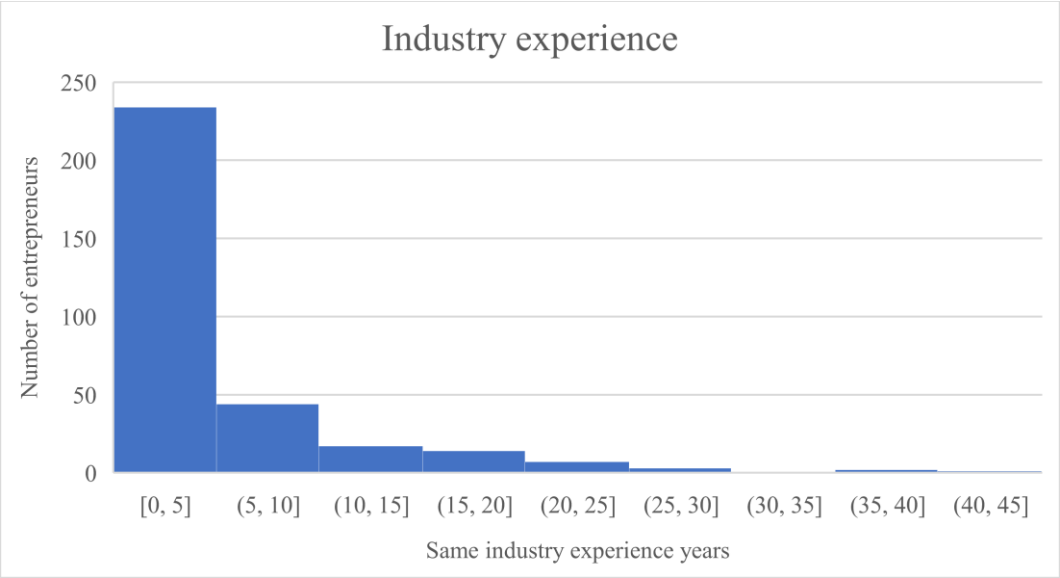


Figure 26: Industry experience

Other information that has been gathered relates to experience in certain fields, particularly in the financial field, which is of no small importance for successful capital raising (Table 9):

Experience	**Number of entrepreneurs**
Research	106
Marketing	93
Strategy	76
ICT	51
Administration	48
Pianification and control	43
Production	28
Finance	26
Purchasing	18

Table 9: Experience

As it can be seen, however, those who have experience in the financial world are relatively few.

86 are the entrepreneurs who have already founded one or more startups in the past, accounting for 21.03% of the total. This fact can be very relevant for raising capital because, as anticipated, many investors prefer to invest in startups with entrepreneurial teams consisting of experienced people who can demonstrate excellent entrepreneurial skills with past experience.

Another very relevant element of the study is whether the entrepreneurs who are part of the team come from the same university or business background; this can influence investors because having a team that is very homogeneous in these two aspects can hurt the business given that having a very similar mindset, due to attending the same university, course of study or company, one might not be able to resolve some problems with different approaches, as the approach used by the various members is precisely very similar (Wencang Zhou, 2014). Therefore, this analysis was done at the level of startups and not individual entrepreneurs; 54 startups had entrepreneurs from the same university, accounting for 35.06%, 46 from the same company, accounting for 29.87%.

Another element that can cause problems for business can be when entrepreneurs are part of the same family (but also if they are friends). This is because when there are disagreements, discussing with a family member may be more difficult than with a person with whom there is no ties other than professional ones. So even this characteristic may be frowned upon by potential investors. There are 12 startups that have entrepreneurs who are part of the same family group, or 7.79% of the total.

Next, some variables of relevant importance at the startup level were aggregated (Table 10):

Variable	**Description**
gen_startup_edu	The number of entrepreneurs who have had an education, which may be in economics, tech or other fields
avg_gen_startup_edu	The average number of years acquired in general education
share_gen_startup_edu	The percentage of entrepreneurs who had a general education
econ_startup_edu	The number of entrepreneurs who have been educated in the field of economics
avg_econ_startup_edu	The average number of years acquired in economics education

share_econ_startup_edu	The percentage of entrepreneurs who were educated in the field of economics
d_econ_startup_edu	This is a dummy variable and indicates whether there is at least one entrepreneur on the team who has pursued a pathway in economics
tech_startup_edu	The number of entrepreneurs who have been educated in tech field
avg_tech_startup_edu	The average number of years acquired in tech education
share_tech_startup_edu	The percentage of entrepreneurs who were educated in tech field
d_tech_startup_edu	It is a dummy variable and indicates whether there is at least one entrepreneur on the team who has been on a pathway in the tech field
other_startup_edu	The number of entrepreneurs who were educated in a field other than economics and tech
avg_other_startup_edu	The average number of years acquired in education in a field other than economics and tech
share_other_startup_edu	The percentage of entrepreneurs who were educated in a field other than economics and tech
d_other_startup_edu	It is a dummy variable and indicates whether there is at least one entrepreneur on the team who has pursued a path in a field other than economics and tech
d_vp_competences	It is a dummy variable and indicates whether there is at least one entrepreneur on the team who has competences inherent the startup field
share_vp_competences	The percentage of entrepreneurs who have competences inherent the startup field

d_fin_exp	This is a dummy variable and indicates whether there is at least one entrepreneur in the team who has experience in finance
share_fin_exp	The percentage of entrepreneurs who have had experience in finance
d_tech_exp	This is a dummy variable and indicates whether there is at least one entrepreneur in the team who has experience in tech
share_tech_exp	The percentage of entrepreneurs who have had experience in the tech field
d_comm_exp	This is a dummy variable and indicates whether there is at least one entrepreneur in the team who has commercial experience
share_comm_exp	The percentage of entrepreneurs who have had experience in the commercial field
d_other_exp	This is a dummy variable and indicates whether there is at least one entrepreneur in the team who has experience in fields other than finance, tech and commercial
share_other_exp	The percentage of entrepreneurs who have had experience in a field other than finance, tech and commercial
d_startup_serial	This is a dummy variable and indicates whether there is at least one entrepreneur in the team who has founded at least one other startup previously
share_startup_serial	The percentage of entrepreneurs who have founded at least one other startup previously
d_startup_female	It is a dummy variable and indicates whether there is at least one female entrepreneur in the team
share_startup_female	The percentage of female entrepreneurs within the startup team

Table 10: Generic entrepreneurial teams variables

Below there is Table 11 showing the percentage of startups that have at least one entrepreneur with certain education and experience characteristics, results obtained from the analysis of dummy variables.

Variable	**Percentage**
d_econ_startup_edu	47,40%
d_tech_startup_edu	33,12%
d_other_startup_edu	77,92%
d_vp_competences	45,45%
d_fin_exp	14,29%
d_tech_exp	60,39%
d_comm_exp	50,00%
d_other_exp	98,05%
d_startup_serial	40,91%
d_startup_female	36,36%

Table 11: Education and experience percentages at startup level

Nearly half of the startups have at least one entrepreneur with an education in economics and a third of them in tech, while the percentage of them with entrepreneurs with educations in other fields is significantly higher. Just under half of startups have at least one entrepreneur with skills inherent in the field in which the startup operates. Only slightly more than 14% of startups have at least one entrepreneur with experience in finance, which can be very helpful in obtaining funding, while more than half have an entrepreneur with experience in tech and economics; almost all also have at least one entrepreneur with other types of experience. Almost half of the startups also have at least one entrepreneur who is not a first-time entrepreneur, a characteristic usually valued positively by investors, and finally, as mentioned above, the number of startups that have female presence within the entrepreneurial team is around one in three.

3.5. Lessons and the applied scientific method

As previously mentioned, the startups were divided into two groups, “control” and “treatment”, and attended lectures that covered 4 topics:

1. The need to obtain external financing;
2. The attraction of investors;
3. The choice of investors;
4. The challenges after funding.

The objective of the lectures was to provide tools, methodologies and case studies for managing financial resources and attracting investors. Each training session included a lecture part and a subsequent talk by an expert in the field. Each lecture started with a case study, then moved on to explain academic theory and do group work to solve problems that entrepreneurs might face in the real life of their startups.

Periodic coaching and monitoring activities also took place after the lectures, preceding the meeting with investors at demo-day.

3.5.1. Lecture 1: The need to obtain external financing

The first lecture was about the need to obtain external financing. Some case studies were shown and the concept of "valley of death" in entrepreneurial finance was explained. In all the case studies, entrepreneurs did not do the right analysis and got wrong financial forecasts. The goal of the lecture was to develop theories that would instead make these startups successful, using sensitivity analysis and what-if analysis, explained in the lecture.

While the teaching stopped here for the control group, the treatment group was taught how to use the scientific method to obtain more reliable theories. The steps illustrated are: theory, hypothesis, test, evaluation and decision.

What needed to be done was to develop a theory (explaining a certain phenomenon), such as the difficulty of attracting funding. It had to be clearly articulated, it had to take into account the alternatives that could be explored, it had to be decomposable and composable as much as possible and it had to be an interconnected set of hypotheses, statements and prepositions. A number of ways of constructing a theory have also been explained, such as the deductive and inductive methods mentioned above, as well as the adductive and analogical methods.

Theories were then developed that could help develop the startup (an example might be that "a deferment of payments, other things being equal, might be appreciable by customers and increase sales").

Hypotheses are then formulated, short, concise sentences that articulate the theory into predictions. They must be consistent with the theory, test one element of the theory at a time, and be accurate and falsifiable. An example, consistent with the previous theory, might be that “in order for customers to purchase it is necessary to recognize a 3-month payment deferment”. Another hypothesis that can be made is "recognizing a 10% discount to customers would result in sales of X”.

The next step is the testing of hypotheses that, as falsifiable, allow verification to validate the theory. This step is divided into two further parts: data collection and testing and both require appropriate rigor and design. For example, one needs to make sure that the sample that will be analyzed is correct and representative and that the testing method is appropriate. Several ways to collect data were also illustrated:

- Secondary data;
- Interaction with successful entrepreneurs;
- Participation to startup events as listeners (such as startup competitions and training events organized by incubators and accelerators);
- Literature.

It was then explained that in the case taken as an example, after moving from theory to hypotheses, an example of data collection could be to collect information on customers' buying behavior through interviews with potential customers, some of whom it’s offered a payment discount and some of whom it is not, and then go to see whether those who are offered payment deferral are more likely to buy.

Once the tests are conducted, the results are evaluated to see if the theories are corroborated or rejected. The evaluation should be based on objective measures and may benefit from comparing the results against a predetermined threshold (if, for example, the percentage of potential customers who actually decide to buy is greater than 20% in the group offered the payment deferral, then the hypothesis can be considered validated) or against a comparison with a control sample (comparing between groups offered the payment deferral and groups not offered).

In summary, it was learned from the first lesson that:

- The definition of capital requirements involves the analysis of revenues and costs and that there is correspondence with cash receipts and expenditures;
- The definition of costs, revenues, income and cash outlays is subject to randomness;

- Therefore, entrepreneurs should formalize strategies to make their estimates more reliable with respect to these dimensions;
- The scientific method can be used to define these strategies.

3.5.2. Lecture 2: The attraction of investors

The second lecture started from the premise that obtaining adequate access to capital is one of the biggest obstacles in starting and growing a new business and a case study regarding this issue was illustrated. The question asked why the study startup could not attract funding and whether the entrepreneurs also had ideas of possible challenges they will face in attracting funding. The question also asked what strategy is to be followed to attract funding and other secondary cases were seen. Some theories concerning obtaining funding are: team quality, key resources and value proposition.

A group work was carried out where it was tried to identify startup priorities and possible strategies for obtaining funding; again, the teaching for the control group ended, while the application of the scientific method for the treatment group was deepened. Using a method similar to that presented in chapter "Lecture 1", theories were created and prioritized. For example, one theory might be that funders invest in entrepreneurial teams that have demonstrated a certain quality. From theory came hypotheses, such as "in the absence of information about the quality of the team, investors do not select the startup for funding", which need to be verified.

Similar to before, data was collected (e.g., by gathering information about the teams of funded startups through Crunchbase, Pitchbook, LinkedIn, such as years of experience as entrepreneurs and in the relevant industry or educational background), and testing was done (e.g., by checking what is the average quality of the teams of funded startups).

In summary, it was learned from the second lesson that:

- Attracting financing is typically complex because of information asymmetries;
- Entrepreneurs should define strategies to reduce information asymmetries and can persuade investors to provide capital;
- The scientific method can help in defining such strategies.

3.5.3. Lecture 3: The choice of investors

Lesson 3 covered the possible sources of funding they can rely on (such as F&F, crowdfunding, public subsidies, business angels, venture capitals, bank loans, private equity and public markets), which have already been discussed in depth. A case study was analyzed and entrepreneurs were asked to fill out a table with their needs (such as managerial expertise, decision-making autonomy and international contacts) and their respective severity. Based on the needs to develop the business, the right funder can be identified; for example, if international contacts and managerial help are needed it might be effective to rely on a VC, if more autonomy is needed it would be better to be financed by a BA, while if feedback on the prototype is needed a crowdfunding campaign could be carried out.

So, the goal of the lesson was for entrepreneurs to understand what sources of funding would be ideal for their businesses, through the use of a table, in which they could also enter multiple lenders.

The treatment group was made to use the scientific method. Theories were created; e.g., "venture capitals enable the attraction of experienced managers", from which hypotheses were formulated, such as "venture capital directly contributes to the professionalization of entrepreneurial teams". Data were collected, such as by talking to other entrepreneurs and asking them how the startup changed after the VCs arrived and testing was done, such as by going to evaluate the team before and after the VC's arrival.

In summary, it was learned from lesson 3 that:

- The choice of investors is closely related to the added value they bring to the business activity;
- The value added that is wanted to bring to the business activity depends on the needs of the business activity;
- Therefore, entrepreneurs should formalize what their needs are in order to accurately choose sources of financing;
- The scientific method can be used to define these strategies.

3.5.4. Lecture 4: The challenges after funding

The last lesson was about post-financing challenges, when entrepreneurs work closely with investors to get the business off the ground ("building winners"), through coaching and strategies to align the interests of entrepreneurs and investors.

Also in this last lecture, a real world case study was taken as a starting point, useful for reasoning about whether conditions proposed by an investor (such as termination of some equity or a seat on the Board of Directors) are permissible.

Similarly, entrepreneurs filled out a table with potential future problems that might arise with investors and their severity and possible ways to overcome such difficulties. Then some tools to protect entrepreneurs and investors were described, such as Way Out clause, Tag Along rights and Drag Along rights, but also many others.

The treatment group used, again, the scientific method to come up with its theories. Among the theories formulated, one was that "venture capitalists or BAs seek alignment with entrepreneurs in terms of growth goals and strategy". From it, assumptions were made, such as " misaligned entrepreneurs are monitored more and with stricter contracts". Data was collected, such as by gathering information on funding rounds of funded startups or by attending events where it's possible to gather information on the types of contracts in place. Then testing was done, going, respectively, to see what the average number of rounds (and amount raised for comparable types of startups) is and testing whether the contract clauses can be accepted.

In summary, what was learned from Lesson 4 is:

- Following the financing, tensions may arise between entrepreneur and investor;
- Tensions can often be traced to the investor's interference in the entrepreneurial activity;
- Therefore, entrepreneurs should formalize tools and ways to overcome critical issues regarding the relationship with investors;
- The scientific method can be used to define these methods.

3.6. Interviews

As anticipated, after the class period, four interviews were conducted with the respondents for each startup in order to collect data on their evolution and continue to help them with the development of their financial plan. The first interview, called the Baseline survey, was conducted

before classes period, done to get a complete picture of startups before giving training to them (with or without the explanation of the scientific method).

For each interview, an interviewer was assigned to a certain number of startups, completely randomly. In total, 13 interviewers (including myself) took part in this phase of the project.

The interviewers' task was precisely to interview the entrepreneurs by telephone, recording (always making the respondent remember this clearly) the call, to ensure transparency of the research project. The interviewers followed a script prepared at the beginning of the program by the research team. This script is essentially an "interview guide", where there were both essential information to be given to respondents and questions, but also considerations for the research assistants.

Prior to the actual interview, they had to be contacted by email or WhatsApp to set up a meeting and remind them to verify that the contents of the short survey they filled out prior to the first interview, to reduce the length of the call, by going only to talk about the possible changes that have taken place. In the message to be sent, which was also defined earlier, it was also explicitly stated that the short interview (of about 15 minutes) was necessary for them to continue participating in the InnoVenture Lab program and have the opportunity to access the final demo day, to entice them to respond.

During the interview they were immediately reminded that the questions are about possible changes that have occurred in the last few weeks in the startup's business model and funding strategies. To reassure respondents, they were also reminded that the recorded data are kept by InnoVenture Lab for research purposes only, and not given to third parties, and they were given the opportunity to ask questions, immediately but also after.

The first question asked is to describe the changes that have been made to the startup's value proposition, such as customers, needs and key advantage.

Next, they were asked to describe the changes that have been made to the startup's business model, possibly getting them to reflect on resources and activities.

The next question asked what new necessary resources for implementing the business model the startup has acquired, such as new human resources (employees, managers or partners), machinery, patents or partnerships with other companies.

While the fourth question asked whether previously unconsidered resources have been identified that are useful for the development of the startup's business model and, if so, how it is planned to access them.

The fifth question, on the other hand, asked whether the entrepreneur has thought (or reconsidered) how much capital the startup needs to implement the development plan over the next 3 years, and if so, the amount, even in the face of possible business changes. Scoring was then done on whether an assessment of the capital needed has already been made, using a Likert scale, with a value of 1 if no assessment was made, 3 if an approximate assessment was made, and 5 if an accurate assessment was made. For coding, six variables were used, according to Table 12. This table explains how to score six distinct theories, which are the core of the scientific approach.

DATABASE VARIABLE	WHAT TO CODE	HOW TO CODE	SCORE (FROM 1 TO 5)
CLEAR_THEORY	The theory is comprehensible (falsifiability)	Score to be given at the end if the exposition was clear 1 = it is not clear how he came to define the sources of funding to be used at their amount 5 = the process that led to defining the funding sources to be used and the amount to be raised for each is very clear	
ELABORATED_THEORY	Theory goes into detail (falsifiability)	If it has considered problems and pros and cons of the various sources, the theory is elaborated	
ALTERNATIVE_THEORY	Theory considers alternative aspects (generalizability)	1 = respondent did not consider alternative sources or develop a plan B 5 = the respondent considered alternative	

		sources and developed a plan B
EVIDENCE_THEORY	The theory has data to support it	1 = the respondent did not collect any data to define ideal sources 5 = the respondent collected sensible data and analyzed it convincingly
MODULAR_THEORY	Theory breaks down the problem into sub-problems to be solved	Assess through question 3) 1 = the problems to be solved were not made modular in any way 5 = the respondent considered the business model as a constraint and optimized the financial choices; in case the solution was not satisfactory, he/she modified the business model, given the financial constraints
HIERARCHICAL_THEORY	Theory helps to prioritize the problems to be solved	Evaluate through question 3 1 = there is no evidence to say that the respondent has prioritized some element over others 5 = the respondent has prioritized over problems to be solved (e.g., first figured out whether to target debt or equity, then defined specific sources

	for the chosen financial instrument. Another example: the respondent is wealthy so he chose to target equity first and then considered whether to seek the rest through debt or equity)

Table 12: Scientific approach evaluation

The sixth question asked how the value of the capital needed for the startup was calculated and how the entrepreneur plans to allocate this capital among the possible uses, bringing, if necessary, some examples of how it could be used, such as purchasing equipment, buying consulting services, hiring more people or people with more qualified skills, investing in market analysis. Scoring was done of this question as well.

The seventh question asked whether the respondent has thought about what sources of funding he plans to use to finance his startup in the next 3 years and how much capital he hopes to raise from each source. In addition, it was asked, in case the startup has changed its business model but did not rethought its sources of funding, whether the sources previously considered are also valid for its startup's current business model, while, in case the startup has reevaluated the amount of capital to be raised but did not rethought its sources of funding, whether the sources previously considered are also valid for raising the capital now. In this case, the scoring aspect is whether the respondent has an idea of how to raise the capital. They were also asked how much equity and debt capital is needed to be raised and which of the following sources of equity and debt capital they intend to use and what is their weight in the total equity capital raised, respectively, following Tables 13 and 14.

SOURCES OF EQUITY CAPITAL	**WEIGHT OF EQUITY CAPITAL**
Personal funds of entrepreneurs	□0% □1-20% □20-40% □40-60% □60-80% □80-99% □100%

Family and friends	□0% □1-20% □20-40% □40-60% □60-80% □80-99% □100%
Equity crowdfunding	□0% □1-20% □20-40% □40-60% □60-80% □80-99% □100%
Business angels	□0% □1-20% □20-40% □40-60% □60-80% □80-99% □100%
Venture capital	□0% □1-20% □20-40% □40-60% □60-80% □80-99% □100%
Equity from companies	□0% □1-20% □20-40% □40-60% □60-80% □80-99% □100%
Other equity (specify)	□0% □1-20% □20-40% □40-60% □60-80% □80-99% □100%

Table 13: Sources of equity capital

SOURCES OF DEBT CAPITAL	**WEIGHT OF DEBT CAPITAL**
Personal debts incurred by entrepreneurs	□0% □1-20% □20-40% □40-60% □60-80% □80-99% □100%
Debts of family and friends	□0% □1-20% □20-40% □40-60% □60-80% □80-99% □100%
Bank debt	□0% □1-20% □20-40% □40-60% □60-80% □80-99% □100%

Table 14: Sources of debt capital

Table 15 and 16 show the percentages of startups that plan to raise capital from a certain equity or debt source and the corresponding percentage of it to the startup's total equity or debt.

Percentage of startups by equity source of funding								
		Personal funds of entrepre-neurs	**Family and friends**	**Equity crowd-funding**	**Business angels**	**Venture capital**	**Equity from compa-nies**	**Other equity**
Source of equity percentage	0%	66.92%	93.75%	72.59%	59.85%	62.41%	79.20%	62.70%
	1-20%	21.80%	3.91%	9.63%	7.58%	7.52%	8.00%	14.29%
	20-40%	5.26%	1.56%	9.63%	15.15%	16.54%	7.20%	7.14%
	40-60%	5.26%	0.78%	5.93%	12.12%	9.77%	4.00%	11.90%
	60-80%	0.75%	0.00%	2.22%	5.30%	3.76%	1.60%	3.97%
	80-100%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

Table 15: Percentage of startups by equity source of funding

Percentage of startups by debt source of funding				
		Personal debts incurred by entrepreneurs	**Debts of family and friends**	**Bank debt**
Source of debt percentage	0%	96.58%	98.61%	75.56%
	1-20%	1.37%	0.69%	10.37%
	20-40%	2.05%	0.69%	9.63%
	40-60%	0.00%	0.00%	4.44%
	60-80%	0.00%	0.00%	0.00%
	80-100%	0.00%	0.00%	0.00%

Table 16: Percentage of startups by debt source of funding

The eighth question asked, whether funding sources or business model have changed, why the entrepreneur thinks the funding sources he mentioned are the most appropriate given his startup's business model and development plans.

The final question pertained to a possible change in the composition of the entrepreneurial team in the last period. It was aimed at determining whether changes have occurred, specifically regarding the names and surnames of individuals who have joined or left from the startup.

The interview is concluded by thanking them for their time, asking if there were any questions and reminding them of the next interview in a few months' time.

After conducting the interview, the recording was archived to ensure transparency to the project. From the recording, a complete transcript was generated and a short transcript was updated, going to insert the changes and going to highlight the changes to the business plan and the financial plan, so that the research assistants, when they would decide which startups could take part in the demo day, could have a more immediate view to the changes made to these two elements of fundamental importance.

Finally, interviewers accessed the Qualtrics Surveys website to fill out the survey dedicated to each startup.

3.6.1. Interviews on funding

Due to the differences between the objective of this thesis and the InnoVenture Lab project, I conducted supplementary surveys independently. These surveys were essential for gathering data on startups, which were crucial for addressing the research question. The project team's interviews, indeed, did not provide any information on the funding acquired by the startups as a result of the training.

Therefore, I contacted again all entrepreneurs, whom I asked if they had obtained at least one investment in the period from the end of the training to December 2023, when the interview was conducted, and the type.

Of the 154 startups that took part in the project, a survey response was obtained from 127 of them (thus 82.47%). Some of them were no longer interested in raising capital, for various reasons (such as having abandoned the project or put it on hold, or for other reasons). So, those still interested (who responded to the survey) are 114.

Of those involved, only 45 obtained at least one investment.

Most of them obtained grants from accelerators, incubators and investment from banks (such as Cassa Depositi Prestiti), followed by BA and then by institutional and private investment funds, VCs, FFFs and tender (one of which was not accepted due to too tight constraints), such as regional tenders, EU or through PnRR. Other means used were partnerships and investments from other companies, facilitated and non-repayable investments, Invitalia, EIT health European Union, CNA Innovation Award, Smart and Start Italia and from universities.

Thus, for those startups that responded to the survey, were still interested in funding and got at least one funding, they were assigned the variable "funding", a dummy variable indicating whether they got at least one investment, with the value 1; and those that responded and were interested, but failed to get even one investment, this variable takes the value 0. This will be explained in more detail in the data analysis. For the other startups, for which there was no response (or the entrepreneur preferred not to respond due to personal preference) no variable was assigned and the startup record has not been used in the analysis.

The information on whether they obtained funding will be indispensable in the data analysis as it is necessary to understand which startups obtained at least one funding in order to understand whether or not the study variables influenced this occurrence.

3.7. The investors

Before turning to the analysis of this data, it is also appropriate to give a very brief description of not only the participating startups but, on the other hand, also the investors who participated in the demo day.

This event was attended by 26 people, divided into three parallel sessions in which pitches were presented by entrepreneurs, from 21 different investment firms: 360 Capital Partners, Banca Generali, LIFTT, e-novia, LTH group, Add Value, Milano Investment Partners, Digital Magics, Bio4Dreams, Boost Heroes, Poste Italiane, Vertis SGR, Alchimia Investments, Viceversa, Cenciarini & Co., Indaco Venture Partners Sgr, a | impact, United Ventures, Doorway, Synergo Capital SGR e Plug & Play. They are all Italian investment companies (or with offices in Italy and also in other countries), except for the last one, which is a U.S. based Early Stage Venture Capital that operates globally. The geographic distribution of these investors follows Figure 27, shown below.

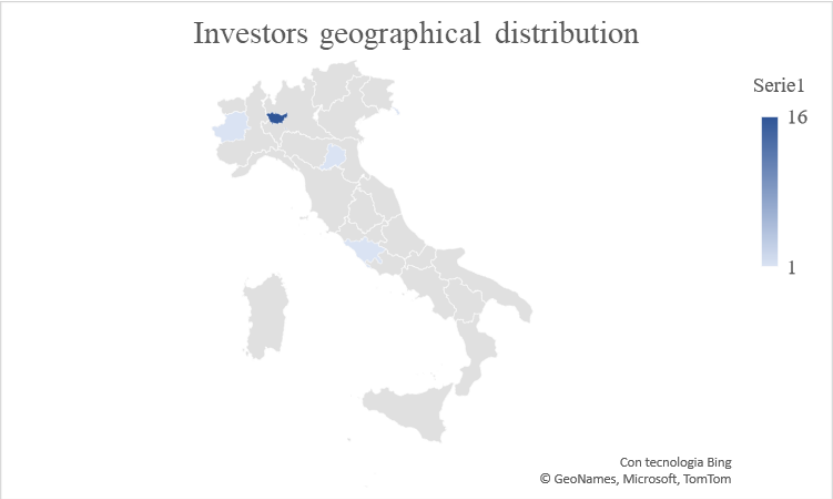


Figure 27: Investors geographical distribution

With the city of Milan where 16 of them are based, while the remaining 4 are based in the cities of Bologna, Turin, Trieste and Rome, evident is the huge disparity in their distribution, which is not only limited between the north and south of the country, as is the case with the startups that participated in the program, but with 80% of them concentrated in the city of Milan alone.

In terms of the type of investors, however, there is some diversity, as shown in Figure 28:

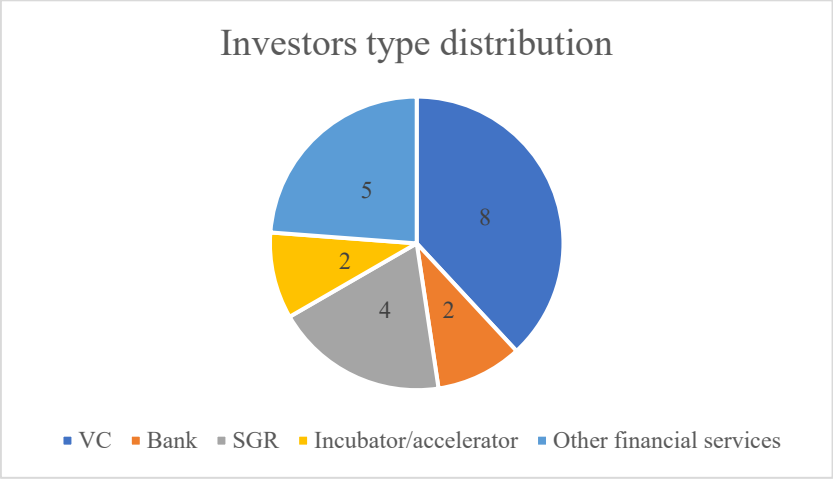


Figure 28: Investors type distribution

Most of them are VCs, followed by Asset Management Companies (SGRs) and then banks, incubators and accelerators. In smaller numbers, other types of financial services are also present,

such as impact investing firms, M&A, PE and VC firms, online equity platforms, alternative investment funds and others.

4. Data analysis

The purpose of the data analysis is to check whether the hypothesis made above are true.

It consists of two parallel but, nonetheless, related approaches to go to answer the research question, i.e., two multiple logistic regressions in which the dependent variable is the same, i.e., the dummy variable "funding", which takes the value 0 in case the startup failed to obtain funding during the period from the end of the training (thus from the last lesson taken during the course) to the day they were interviewed and asked if they had obtained funding (December 2023), while 1 if they managed to obtain at least one funding during this period. The independent study variables, on the other hand, are different in the two regressions:

- In the first model, the study variable is the variable "treatment_dummy", a dummy variable, which can then take the values 1 or 0, respectively in cases where the startup has undergone treatment or not;
- In the second regression, the study variable is the "scientificity" variable, a continuous variable representing how scientifically the various startups behave. The construction of this variable was carried out as follows: the ratings given by the interviewers following the training were considered; then, averages were made on the ratings present from round 2 to 5 for each startup.

Control variables were included in both regressions to go to best capture the effect that the independent variable has on the dependent variable.

The difference between the two models, as previously explained, is that the first approach is the last step of the RCT, in which the independent variable is the dummy variable indicating whether the startups took part in the control or treatment group, whereas for the second approach it can no longer be defined as an RCTs because, although the data that go to create the control variables were acquired during the RCT experiment, the variable introduced as the independent study variable, "scientificity", is the average of the ratings given, thus the result of surveys, which are not a step in the RCT. Thus, it is no longer a scientific experiment like the RCT, but, still, it is very significant, as surveys are used in different fields of econometrics.

4.1. Variables

The variables used for the two logistic regressions are described below in Table 17:

Variable name	**Type**	**Description**
Funding (Y)	Dummy (0 or 1)	It is the dependent variable and takes the value 1 if the startup has obtained at least one funding, 0 otherwise
Treatment_dummy (X1)	Dummy (0 or 1)	Indicates whether the startup has undergone treatment, so it takes the value 1 if the startup is part of the treatment group and 0 if it is part of the control group
Scientificity (X2)	Real (from 1 to 5)	Represents how scientifically a startup makes decisions. It is equal the average of survey results on the interview rounds following the training. It takes the value 1 if the startup does not behaves scientifically, 5 if it behaves very scientifically
N_team_members	Natural	Indicates the number of entrepreneurs who compose the entrepreneurial team
N_employees	Natural	Indicates the number of employees who are part of the startup
D_bachelor	Dummy (0 or 1)	Indicates whether within the entrepreneurial team at least one entrepreneur holds a bachelor's degree
D_ms	Dummy (0 or 1)	Indicates whether within the entrepreneurial team at least one entrepreneur holds a master's degree

D_post_lauream	Dummy (0 or 1)	Indicates whether within the entrepreneurial team at least one entrepreneur holds a postgraduate degree
D_phd	Dummy (0 or 1)	Indicates whether within the entrepreneurial team at least one entrepreneur holds a PhD
D_same_uni	Dummy (0 or 1)	Indicates whether at least two entrepreneurs studied at the same university. Takes the value 1 if they studied at the same university, 0 otherwise
D_same_firm	Dummy (0 or 1)	Indicates whether at least two entrepreneurs have worked in the same company. Takes the value 1 if they worked in the same company, 0 otherwise
D_same_family	Dummy (0 or 1)	Indicates whether at least two entrepreneurs are from the same family. Takes the value 1 if they are part of the same family, 0 otherwise
Share_econ_startup_edu	Percentage (from 0 to 1)	Indicates the percentage of entrepreneurs within the team who have an education in economics
Share_tech_startup_edu	Percentage (from 0 to 1)	Indicates the percentage of entrepreneurs within the team who have a tech education
Share_fin_exp	Percentage (from 0 to 1)	Indicates the percentage of entrepreneurs within the team who have finance experience
Share_tech_exp	Percentage (from 0 to 1)	Indicates the percentage of entrepreneurs within the team who have experience in the tech field
D_econ_startup_edu	Dummy (0 or 1)	Indicates whether at least one entrepreneur with economics

		education is present in the startup. Takes the value 0 if not even one is present, 1 if at least one is present
D_tech_startup_edu	Dummy (0 or 1)	Indicates whether at least one entrepreneur with education in tech is present in the startup. It takes the value 0 if not even one is present, 1 if at least one is present
D_fin_exp	Dummy (0 or 1)	Indicates whether at least one entrepreneur with financial experience is present in the startup. Takes the value 0 if not even one is present, 1 if at least one is present
D_tech_exp	Dummy (0 or 1)	Indicates whether at least one entrepreneur with experience in the tech field is present in the startup. It takes the value 0 if not even one is present, 1 if at least one is present
D_startup_serial	Dummy (0 or 1)	Indicates whether there is at least one entrepreneur with prior entrepreneurial experience within the entrepreneurial team (i.e., whether he or she has already founded at least one other startup). Takes the value 0 if none is present, 1 if at least one is present
Share_startup_female	Percentage (from 0 to 1)	Indicates the percentage of female entrepreneurs within the entrepreneurial team
Startup_age	Natural	Indicates the age of the startup
D_services	Dummy (0 or 1)	Indicates whether the startup operates in the service field. Takes the value 1 if it operates in this field, 0 if it operates in another one

Geography	Dummy (0 or 1)	Indicates whether the startup has its registered office in northern or southern Italy. It takes the value 1 if the startup resides in the north, 0 in the south
Industry (ICT)	Dummy (0 or 1)	Indicates whether the startup operates in the ICT industry. Takes the value 1 if it operates in this industry, 0 otherwise
Legal_form (SRL)	Dummy (0 or 1)	Indicates whether the startup is an SRL, taking the value 1 if so, 0 otherwise
D_vp_competences	Dummy (0 or 1)	Indicates whether there is at least one entrepreneur within the entrepreneurial team who has skills related to the field in which the startup operates, taking the value 1 if present, 0 otherwise

Table 17: Logistic Regression variables

Statistical description of variables

The following is a statistical description of the variables described in the previous chapter. In Table 18, for each variable, the following was reported:

- Count: number of observations;
- Mean: mean of values;
- Std: standard deviation;
- Min: minimum value;
- Max: maximum value.

	count	mean	std	min	max
funding (Y)	114	0.3772	0.4868	0	1
treatment_dummy (X1)	154	0.5000	0.5016	0	1
Scientificity (X2)	153	2.5475	1.0511	1	5
n_team_members	154	2.1558	1.6455	0	10
n_employees	154	1.1169	2.8121	0	30
d_bachelor	153	0.8693	0.3382	0	1
d_ms	153	0.7386	0.4409	0	1
d_ post lauream	153	0.4837	0.5014	0	1
d_phd	153	0.1699	0.3768	0	1
d_same_uni	152	0.3553	0.4802	0	1
d_same_firm	152	0.3026	0.4609	0	1
d_same_family	154	0.0779	0.2689	0	1
share_econ_startup_edu	153	0.2892	0.3633	0	1
share_tech_startup_edu	154	0.1978	0.3206	0	1
share_fin_exp	150	0.0953	0.2648	0	1
share_tech_exp	154	0.3744	0.3789	0	1
d_econ_startup_edu	154	0.4740	0.5010	0	1
d_tech_startup_edu	153	0.3333	0.4730	0	1
d_fin_exp	150	0.1467	0.3550	0	1
d_tech_exp	154	0.6039	0.4907	0	1
d_startup_serial	153	0.4118	0.4938	0	1
share_startup_female	154	0.1887	0.3056	0	1
startup_age	154	2.7078	2.0924	1	12
d_services	154	0.7532	0.4325	0	1
geography	154	0.6039	0.4907	0	1
industry (ICT)	154	0.4351	0.4974	0	1
legal_form (SRL)	154	0.6299	0.4844	0	1
d_vp_competences	148	0.4730	0.5010	0	1

Table 18: Statistical description of variables

The startups that got funding are 43 out of the 114 that responded to the survey, thus accounting for 37.72%. Of them, 23 got the treatment (53.48%) while those that did not were 20 (46.52%). On the other hand, as for the startups that did not get funding (71), those that got the treatment

are 34 (47.89%) while the ones from the control group are 37 (52.11%). This shows that, without considering other control variables, startups that had the treatment are more likely to get funding. It is summarized in Table 19.

	Treatment	Control
Funding	23	20
No funding	34	37

Table 19: Funding

The number of entrepreneurs ranges from 1 to 10, with an average of 2.15, while some startups do not even have one employee and one goes up to 30; the average number of employees is 1.11, underscoring that startups are mainly composed of entrepreneurs (65.87%) than employees (34.13%), with a entrepreneurs-employees ratio reaching almost 2.

Regarding degrees, the percentage of startups that have at least one entrepreneur with the various degrees decreases as the degree level increases, from an 86.93% of startups that have at least one entrepreneur with a bachelor's degree reaching a 16.99% of startups that have at least one entrepreneur with a PhD.

Regarding the presence of entrepreneurs from the same university or company, nearly 1/3 of startups have at least 2 entrepreneurs who meet this characteristic; in contrast, the percentage of startups with entrepreneurs from the same family falls to a threshold of less than 8%.

As for the variables indicating whether there is at least one entrepreneur or their percentage in the entrepreneurial team who have economics or tech education or experience in finance or tech field, it can be seen that a very large proportion of them have tech experience while very few of them have finance experience; intermediate is the number of them with education in economics and tech subjects.

More than 4 out 10 startups have at least one entrepreneur who has previously founded at least one other startup.

The presence of women is significantly lower than that of men.

The age of startups has a mean value of 2.71, with a very high standard deviation of 2.09, as most startups have a life span of less than 1-2 years (75% of them have up to 4 years) but there are outliers, such as a startup that has a life span of 12 years.

Most startups work in the service sector (more than 75%), reside in northern Italy (more than 60%), and have SRL (almost 63%) as their legal form.

A large proportion of them (43.5%) also work in the ICT industry.

Finally, there are many startups that have at least one entrepreneur who has the skills consistent with the field in which the startup operates.

4.2. Correlation analysis

Before proceeding with the regression analysis, a correlation analysis was carried out to check that there were no strong multicollinearities between the variables.

This analysis consists of going to measure the strength and direction of the linear relationship between two quantitative variables. The result of this analysis is a correlation matrix that relates all the variables through a coefficient (often used that of Person).

This coefficient varies between -1 and 1, where 1 indicates perfect positive correlation, -1 indicates perfect negative correlation and 0 indicates no linear correlation between the two variables.

Multicollinearity occurs when two or more variables that are independent of each other in a multiple regression are strongly correlated with each other, making it difficult to separate the effect that each variable has on the dependent variable; therefore, to best analyze each variable, it is important to eliminate any variables that are strongly correlated with others.

Usually, correlation is classified as shown in Table 20:

Correlation	**Classification**
0.0 – 0.2	Very weak
0.2 – 0.4	Weak
0.4 – 0.6	Moderate
0.6 – 0.8	Strong
0.8 – 1.0	Very strong

Table 20: Correlation values

And those variables with a very high correlation, such as greater than 0.8 are eliminated.

The following figure (Figure 10) shows the correlation matrix under consideration.

Table 21: Correlation matrix

	treatment_ dummy (X1)	scientificity	n_team_ members	n_employees	d_bachelor	d_ms	d_ post lauream	d_phd	d_same_uni	d_same_firm	d_same_ family	share_econ_ startup_edu	share_tech_ startup_edu	share_fin_ exp	share_tech_ exp	d_econ_ startup_edu	d_tech_ startup_edu	d_fin_exp	d_tech_exp	d_startup_ serial	share_startup female	startup_age	d_services	geography	industry (ICT)	legal_form (SRL)	d_vp_ competences
treatment_dummy (X1)	1.0000	0.0318	0.0000	0.0463	-0.0413	0.0854	0.0325	0.0726	0.1197	0.0946	0.0000	-0.0062	0.1645	0.0074	0.0612	-0.0390	0.1571	0.0377	-0.0133	0.0453	-0.0526	0.0654	-0.0602	0.0133	-0.1703	0.0403	0.0812
scientificity (X2)	0.0318	1.0000	0.0449	-0.0507	0.0383	0.1605	-0.0035	0.0905	0.0962	0.1357	-0.0224	0.1053	0.0801	0.0529	0.1123	0.0986	0.0925	0.0265	0.1613	0.0533	0.0071	0.1021	-0.1217	-0.0163	-0.1041	0.0768	0.1348
n_team_members	0.0000	0.0449	1.0000	-0.1297	0.2510	0.3036	0.1903	0.2516	0.4659	0.2709	0.2382	-0.0575	-0.0180	-0.0944	-0.0963	0.1873	0.1517	0.0740	0.1822	0.0865	-0.0308	0.0323	0.0360	-0.0202	0.1083	-0.0338	0.2196
n_employees	0.0463	-0.0507	-0.1297	1.0000	0.1068	0.1004	-0.0428	0.1348	-0.0298	-0.0866	0.0052	0.1567	-0.0140	0.2570	0.1695	0.1042	-0.0164	0.1891	0.1190	0.0528	-0.0402	0.2080	0.0884	-0.0373	0.0942	0.0176	-0.0114
d_bachelor	-0.0413	0.0383	0.2510	0.1068	1.0000	0.6518	0.3753	0.1755	0.2889	0.0870	-0.0311	0.3126	0.2411	-0.0070	0.0515	0.3704	0.2686	0.0517	0.0857	0.0093	-0.0699	0.1043	-0.0883	-0.1129	-0.0095	0.1022	0.3298
d_ms	0.0854	0.1605	0.3036	0.1004	0.6518	1.0000	0.3080	0.2692	0.3731	0.1575	0.0629	0.1879	0.2460	-0.0740	0.1985	0.2705	0.2899	0.0309	0.2533	0.1049	0.0259	0.1529	0.0023	-0.0209	-0.0745	0.0645	0.3998
d_ post lauream	0.0325	-0.0035	0.1903	-0.0428	0.3753	0.3080	1.0000	-0.1245	0.1944	-0.0026	0.1555	0.4377	0.1588	0.0002	-0.0839	0.5157	0.1720	0.0865	0.0005	0.1735	0.0204	-0.0233	-0.0188	-0.0531	0.0948	-0.0658	0.0000
d_phd	0.0726	0.0905	0.2516	0.1348	0.1755	0.2692	-0.1245	1.0000	0.3564	0.2712	0.1269	-0.1202	0.3177	0.0560	0.1929	-0.0490	0.3802	0.1180	0.2565	-0.0603	-0.0360	0.1787	-0.2232	0.0070	-0.1538	0.0967	0.2739
d_same_uni	0.1197	0.0962	0.4659	-0.0298	0.2889	0.3731	0.1944	0.3564	1.0000	0.1992	0.1395	0.0751	0.1452	-0.1168	-0.0343	0.2219	0.2971	0.0128	0.1399	-0.0567	-0.0424	-0.0086	0.0046	-0.0474	-0.1053	-0.0781	0.2059
d_same_firm	0.0946	0.1357	0.2709	-0.0866	0.0870	0.1575	-0.0026	0.2712	0.1992	1.0000	0.0727	-0.0095	-0.0088	-0.0290	-0.0663	0.0260	0.0541	0.0147	0.0251	-0.0222	0.0724	0.2011	-0.0935	0.0339	-0.1522	0.1553	0.2084
d_same_family	0.0000	-0.0224	0.2382	0.0052	-0.0311	0.0629	0.1555	0.1269	0.1395	0.0727	1.0000	-0.0201	-0.0276	0.1108	0.0382	0.0151	0.0516	0.2251	0.1364	0.0523	-0.0714	0.0059	0.0540	-0.1113	0.1358	0.0222	-0.0105
share_econ_startup_edu	-0.0062	0.1053	-0.0575	0.1567	0.3126	0.1879	0.4377	-0.1202	0.0751	-0.0095	-0.0201	1.0000	-0.1636	0.1287	-0.0202	0.8473	-0.1438	0.1829	-0.0320	0.2169	-0.0897	-0.0265	0.1086	0.0622	0.1461	0.1211	-0.2328
share_tech_startup_edu	0.1645	0.0801	-0.0180	-0.0140	0.2411	0.2460	0.1588	0.3177	0.1452	-0.0088	-0.0276	-0.1636	1.0000	-0.0623	0.2085	-0.1761	0.8791	-0.0358	0.1176	-0.0276	0.0346	0.1615	-0.1675	-0.0810	-0.0900	0.0695	0.3438
share_fin_exp	0.0074	0.0529	-0.0944	0.2570	-0.0070	-0.0740	0.0002	0.0560	-0.1168	-0.0290	0.1108	0.1287	-0.0623	1.0000	0.1039	0.0675	-0.0808	0.8709	0.0745	0.0617	-0.1584	-0.0123	-0.0263	0.0835	0.0539	0.0763	-0.0900
share_tech_exp	0.0612	0.1123	-0.0963	0.1695	0.0515	0.1985	-0.0839	0.1929	-0.0343	-0.0663	0.0382	-0.0202	0.2085	0.1039	1.0000	-0.0777	0.1186	0.0966	0.8029	0.0653	0.0550	0.0405	-0.1753	-0.0959	-0.0150	0.1199	0.1366
d_econ_startup_edu	-0.0390	0.0986	0.1873	0.1042	0.3704	0.2705	0.5157	-0.0490	0.2219	0.0260	0.0151	0.8473	-0.1761	0.0675	-0.0777	1.0000	-0.1203	0.1996	0.0509	0.2643	-0.0624	0.0270	0.0909	0.0775	0.1112	0.1083	-0.1368
d_tech_startup_edu	0.1571	0.0925	0.1517	-0.0164	0.2686	0.2899	0.1720	0.3802	0.2971	0.0541	0.0516	-0.1438	0.8791	-0.0808	0.1186	-0.1203	1.0000	-0.0153	0.1136	-0.0322	-0.0248	0.1325	-0.1835	-0.1321	-0.0652	0.0287	0.4497
d_fin_exp	0.0377	0.0265	0.0740	0.1891	0.0517	0.0309	0.0865	0.1180	0.0128	0.0147	0.2251	0.1829	-0.0358	0.8709	0.0966	0.1996	-0.0153	1.0000	0.1304	0.0672	-0.1195	-0.0279	-0.0318	0.0970	0.0558	0.0473	-0.0893
d_tech_exp	-0.0133	0.1613	0.1822	0.1190	0.0857	0.2533	0.0005	0.2565	0.1399	0.0251	0.1364	-0.0320	0.1176	0.0745	0.8029	0.0509	0.1136	0.1304	1.0000	0.1552	0.0718	0.1030	-0.0940	-0.1130	0.0412	0.0941	0.1379
d_startup_serial	0.0453	0.0533	0.0865	0.0528	0.0093	0.1049	0.1735	-0.0603	-0.0567	-0.0222	0.0523	0.2169	-0.0276	0.0617	0.0653	0.2643	-0.0322	0.0672	0.1552	1.0000	-0.1825	0.1023	0.0814	0.0192	0.0378	0.2052	-0.1059
share_startup_female	-0.0526	0.0071	-0.0308	-0.0402	-0.0699	0.0259	0.0204	-0.0360	-0.0424	0.0724	-0.0714	-0.0897	0.0346	-0.1584	0.0550	-0.0624	-0.0248	-0.1195	0.0718	-0.1825	1.0000	0.0308	0.0056	0.0253	-0.0668	-0.0548	0.0527
startup_age	0.0654	0.1021	0.0323	0.2080	0.1043	0.1529	-0.0233	0.1787	-0.0086	0.2011	0.0059	-0.0265	0.1615	-0.0123	0.0405	0.0270	0.1325	-0.0279	0.1030	0.1023	0.0308	1.0000	-0.1163	0.1157	-0.0906	0.4472	0.1546
d_services	-0.0602	-0.1217	0.0360	0.0884	-0.0883	0.0023	-0.0188	-0.2232	0.0046	-0.0935	0.0540	0.1086	-0.1675	-0.0263	0.1753	0.0909	-0.1835	-0.0318	-0.0940	0.0814	0.0056	-0.1163	1.0000	-0.0016	0.3504	-0.1268	-0.1719
geography	0.0133	-0.0163	-0.0202	-0.0373	-0.1129	-0.0209	-0.0531	0.0070	-0.0474	0.0339	-0.1113	0.0622	-0.0810	0.0835	-0.0959	0.0775	-0.1321	0.0970	-0.1130	0.0192	0.0253	0.1157	-0.0016	1.0000	-0.1195	0.1766	-0.1685
industry (ICT)	-0.1703	-0.1041	0.1083	0.0942	-0.0095	-0.0745	0.0948	-0.1538	-0.1053	-0.1522	0.1358	0.1461	-0.0900	0.0539	-0.0150	0.1112	-0.0652	0.0558	0.0412	0.0378	-0.0668	-0.0906	0.3504	-0.1195	1.0000	0.1030	-0.2532
legal_form (SRL)	0.0403	0.0768	-0.0338	0.0176	0.1022	0.0645	-0.0658	0.0967	-0.0781	0.1553	0.0222	0.1211	0.0695	0.0763	0.1199	0.1083	0.0287	0.0473	0.0941	0.2052	-0.0548	0.4472	-0.1268	0.1766	0.1030	1.0000	-0.0263
d_vp_competences	0.0812	0.1348	0.2196	-0.0114	0.3298	0.3998	0.0000	0.2739	0.2059	0.2084	-0.0105	-0.2328	0.3438	-0.0900	0.1366	-0.1368	0.4497	-0.0893	0.1379	-0.1059	0.0527	0.1546	-0.1719	-0.1685	-0.2532	-0.0263	1.0000

It can immediately be seen that the highest correlations occur between the variables d_econ_startup_edu with share_econ_startup_edu, d_tech_startup_edu with share_tech_startup_edu, d_fin_exp with share_fin_exp and d_tech_exp with share_tech_exp, with positive correlations greater than 0.8, thus very strong correlations that can alter the effect of individual variables on the dependent variable. Such correlations are normal given that the correlation that a startup has at least one entrepreneur with some education or experience and the share of entrepreneurs within the team who have that characteristic is predictable. For this reason, in order not to have collinearity problems, the variables related to share were eliminated, keeping the dummy ones (it was decided to eliminate these variables because in a preliminary regression they had the largest p-values compared with the respective dummy variables).

Another positive and high value among the correlations is recorded between the d_bachelor and d_ms variables, as it is very likely that entrepreneurs who have a bachelor's degree also have a master's degree.

The correlation between treatment_dummy and scientificity is very low, close to 0, indicating that there is no correlation between the scientific behavior of startups and whether they got treatment; however, it should be remembered that the correlation does not indicate whether there is a cause-and-effect relationship between the variables.

Scientificity does not have very high correlation values with the other variables since with no other variable it has correlation values greater than "very weak".

Other variables with rather high correlations are n_team_members with d_same_uni (0.47), d_bachelor with d_econ_startup_edu (0.37), d_ms with d_same_uni (0. 37), d_ms with d_vp_competences (0.40), d_ postgraduate with share_econ_startup_edu (0.44) and with d_econ_startup_edu (0.52), d_phd with d_same_uni (0. 36) and with d_tech_startup_edu (0.38), share_tech_startup_edu with d_vp_competences (0.34), d_tech_startup_edu with d_vp_competences (0.45), startup_age with legal_form (SRL) (0.45), d_services with industry (ICT) (0.35) but they are all values within the "weak" and "moderate" ranges.

Thus, in addition to the four variables discussed above, no other variables were eliminated.

4.3. Regression analysis

This section then reports the regressions performed, which are essential for understanding the truthfulness of the hypotheses previously made.

The model that was used is multiple logistic regression, using the MLE (Maximum Likelihhod Estimation) method which models the probability that the dependent variable takes the value 1.

For each hypothesis (and approach) the coefficients of the variables used, their standard errors, z-values, p-values and 95% confidence interval were, then, calculated, along with other factors such as:

- Number of observations: the number of records used to build the model;
- Df Residuals: the number of residual degrees of freedom, which is determined by subtracting the number of estimated parameters (including the intercept term) from the total number of observations. It shows how many observations are subject to variation once the model has estimated the parameters;
- Df Model: the number of parameters in the model that were estimated from the data, omitting the constant term (intercept). This is the number of predictors, or independent variables, that the model contains;
- Pseudo R-Squared: the metric in question aims to quantify the degree to which the model accurately represents the data, similar to the coefficient of determination R-squared employed in linear regressions. There exist several versions of the pseudo R-squared metric, with McFadden's R-squared being the most widely recognized. However, it is generally observed that a larger pseudo R-squared value signifies a better fit of the model to the data;
- Log-Likelihood: the logarithm of the likelihood function, often known as log-likelihood, serves as an indicator of the degree to which a statistical model aligns with the observed data;
- LL-Null: the log-likelihood of the null model refers to the logarithm of the likelihood function for a model that includes only the intercept and no predictors. This figure serves as a benchmark for assessing the level that the model's predictors improve the goodness of fit;
- LLR p-value: the log-likelihood of the full model (with predictors) vs the log-likelihood of the null model (intercept only) is what the Likelihood Ratio Test's p-value compares. This test determines whether the model's goodness of fit relative to the null model is considerably improved by including the predictors. A low p-value (usually less than 0.05) indicates that the predictors offer significant information for explaining the dependent variable. This suggests that the overall model exhibits a much higher goodness of fit compared to the null model.

Therefore, it is essential to examine the p-value associated with each variable, with particular emphasis on the variable of interest. When the p-value is below 0.05, it indicates that the evidence against the null hypothesis (H0), which states that the variable in question does not have an impact on the dependent variable, is sufficiently robust to consider the results statistically significant at a significance level of 5%.

For variables with a p-value less than 0.05, therefore statistically significant, the sign of the coefficient can be discussed. The coefficients represent the logarithmic effect of a unit change in the independent variable on the log-odds (logit), i.e., the ratio of the probability of an event occurring to the probability of it not occurring, that the dependent variable is equal to 1.

4.3.1. Approach 1

The hypothesis of this thesis argues that startups that use the scientific method to make decisions are more likely to get funding from investors.

Using the first approach that makes use of the variable "treatment_dummy" as an indication of the use of the scientific method, this statement translates into the following model:

$$\ln\left(\frac{Prob(funding)}{1 - Prob(funding)}\right) = \beta_0 + \beta_1 treatment_{dummy} + \gamma_i controls_i$$

Where:

- β_0 is the constant, which is the intercept term of the equation. It is the log-odds value of the dependent variable when all independent variables are zero;
- β_1 is the coefficient of the independent variable (treatment_dummy) in the logistic regression model. It indicates the change in the log-odds of the dependent variable for one unit change in the independent variable, holding all other independent variables constant;
- γ_i are the regression coefficients associated with the control variables.

To get a more intuitive idea of the increase or decrease in the probability of obtaining financing, the following formula can be used. Within it one must enter the values of the regressors and

variables of a startup. By going to vary the value of one variable at a time, one can see the effect, thus the increase or decrease in the probability of obtaining funding.

$$p(funding) = \frac{1}{1 + e^{-(\beta_0+\beta_1 X_1+\beta_2 X_2+\cdots+\beta_N X_N)}}$$

Table 22 shows the result of the multiple logistic regression model obtained:

Logistic Regression Results 1						
				No. Observations:		107
Dep. Variable		funding (Y)		Df Residuals:		84
Model		Logit		Df Model:		22
Method		MLE		Pseudo R-squ.:		0.2339
				Log-Likelihood:		-54.133
				LL-Null:		-71.219
				LLR p-value:		0.04719
Variable	**coef**	**std err**	**z**	**P>|z|**	**[0.025**	**0.975]**
const	-2.3163	1.486	-1.559	0.119	-5.229	0.596
treatment_dummy (X1)	0.344	0.519	0.663	0.507	-0.672	1.36
n_team_members	0.4988	0.206	2.423	0.015	0.095	0.902
n_employees	0.2046	0.169	1.208	0.227	-0.127	0.537
d_bachelor	1.7175	1.373	1.251	0.211	-0.974	4.409
d_ms	-0.5293	0.768	-0.689	0.491	-2.034	0.975
d_ post lauream	-0.8406	0.707	-1.189	0.234	-2.226	0.545
d_phd	0.6499	0.782	0.831	0.406	-0.884	2.183
d_same_uni	-0.2622	0.655	-0.4	0.689	-1.546	1.022
d_same_firm	-0.3403	0.588	-0.579	0.563	-1.493	0.813
d_same_family	0.5065	1.028	0.493	0.622	-1.508	2.521
d_econ_startup_edu	0.8571	0.758	1.13	0.258	-0.629	2.343
d_tech_startup_edu	-0.2403	0.702	-0.342	0.732	-1.617	1.136
d_fin_exp	-1.5574	0.813	-1.917	0.055	-3.15	0.035
d_tech_exp	-0.884	0.602	-1.468	0.142	-2.064	0.296
d_startup_serial	0.0661	0.6	0.11	0.912	-1.109	1.242
share_startup_female	-2.3682	1.168	-2.028	0.043	-4.657	-0.079
startup_age	-0.2459	0.16	-1.538	0.124	-0.559	0.067
d_services	0.7315	0.724	1.011	0.312	-0.687	2.15
geography	-0.1943	0.623	-0.312	0.755	-1.416	1.028
industry (ICT)	-0.7423	0.649	-1.144	0.253	-2.014	0.53
legal_form (SRL)	0.9041	0.711	1.272	0.203	-0.489	2.297
d_vp_competences	0.4514	0.671	0.672	0.501	-0.865	1.767

Table 22: Logistic Regression 1

The observation number equals 107 and not 154 because all those records whose funding were unknown were eliminated, and also those records that had missing values; the Pseudo R-squared reaches almost 0.24, a sufficiently high value but, still, improvable.

The LLR p-value is less than 0.05, meaning that there is a statistically significant difference between the full model (which includes the predictors of interest) and the null model (which includes only the intercept term, without any predictors), significantly improving the goodness of the model, leading us to reject the null hypothesis, according to which the observed difference (or a more extreme one) between the log-likelihoods of the two models is not due to the predictors included in the model.

The coefficient β_0 is negative.

The study variable "treatment_dummy" has a positive coefficient, meaning that it has a positive influence on the probability of obtaining funding, although it is not statistically significant, as it has a p-value far above the value of 0.05, which is necessary for it to be considered statistically significant. With this result, obtained through the first approach, it is therefore not possible to support the claim that the scientific method, imparted through the training, has a positive influence on the probability of obtaining funding.

However, it is possible to analyze the control variables, going to see which variables are statistically significant and how they affect the probability of obtaining funding.

The only variables that are statistically significant are n_team_members and share_startup_female, as they have p-values less than 0.05.

The coefficient of the n_team_members regressor has a positive coefficient since it increases the likelihood that startups will obtain funding if they have a large and robust team of entrepreneurs at their helm instead of just one entrepreneur (Teltch, 2021). This is because a large team of entrepreneurs (however within certain limits) brings to the startup more skills, efficiency and thus is viewed favorably by potential investors. (Tamvada, 2011)

The other variable that is statistically significant is share_startup_female, having also a p-value less than 0.05. Its coefficient is negative, indicating the fact that an increase in the percentage of women within the entrepreneurial team plays a negative role on obtaining funding. It is evident that a bias still exists, as in several other work fields, regarding the female figure (TEDx, 2017), while some studies show otherwise, claiming that "startups founded and co-founded by women have actually performed better over time, generating 10% more cumulative revenue over a five-year period" (BCG, 2018).

Other variables with p-values less than 0.05 are not present, but, nevertheless, the coefficients of all other variables present, even if not statistically significant, can be commented.

N_employees has a positive coefficient, so, similarly to the variable n_team_members, it acts positively on the probability of obtaining funding. Startups with many employees may be seen as better investments than startups with a small number of workers, as the latter may be riskier. In addition, in the entrepreneurial world, employees themselves can often make decisions and give a great deal of input into the choices made by management, which is in high demand by the entrepreneurial team itself.

D_bachelor, d_ms, d_post_lauream and d_phd have both positive and negative values and very high p-values. While the signs of d_bachelor and d_phd are intuitive, since startups with at least one entrepreneur with a bachelor's degree or phd should attract in an easier way funding, the negative sign of the other two variables is not entirely intuitive, given that, all other variables being equal, an entrepreneurial team consisting of entrepreneurs with higher degrees should be deemed more reliable.

D_same_uni and d_same_firm both have negative coefficients, indicating the fact that if there are people within the entrepreneurial team who come from the same previous university or company, this may be viewed poorly by potential investors, as it may be perceived that entrepreneurs may have approaches to problems and thus to decision making that are too similar, without, therefore, having different and complementary approaches and different points of view that can be very helpful. D_same_family, on the other hand, has a positive coefficient, although, again, it is usually frowned upon by investors as having people from the same family within the entrepreneurial team can be a problem because it is more difficult for constructive conflicts to arise.

Then the variables regarding education and previous experience were analyzed. Only d_econ_startup_education has a positive coefficient, indicating that the presence of at least one entrepreneur with a university background in the economics field gives added value for raising capital, while d_tech_startup_edu, d_fin_exp and d_tech_exp have negative coefficients; this is counterintuitive since having at least one person with both university and work skills in the tech field and financial experience should benefit capital raising.

D_startup_serial, which indicates whether there is at least one entrepreneur with prior entrepreneurial experience, has a positive coefficient, benefiting the probability of obtaining funding. This is consistent with many other studies (Teltch, 2021).

Startup_age has a negative coefficient, implying that a more mature startup is less likely to obtain funding. This is usually not the case, as moving from an early to a more mature stage reduces the risk of the startup's failure, making it a safer investment (although in later stages the investment

needed may be greater than in the early stages, thus not feasible by all kind of investors). The peculiarity of these startups is that in order to participate in this project they had to be startups with no external financiers already in place. This implies that a startup that already has a certain life that has not yet obtained funding may be hiding problems and therefore appears in the eyes of potential new investors as risky.

D_services has a positive sign. It is well known that startups operating in the field of services may have advantages over others in the raise of capital, as this field is much less capital intensive than others and therefore can give greater returns on investment and in less time (Nguyen, 2020).

The geography variable has a negative coefficient, although close to 0 and with a very high p-value, indicating that startups in the north are less likely to obtain funding. This heterogeneity is in line with the number of startups in Italian regions, as, for example, Lombardy is immediately followed by Lazio and Campania. Thus, an absence of concentration of startups in a single region is correlated with an absence of concentration of investment in the same region.

Industry (ICT) impacts negatively, with a negative coefficient. Although this field attracts a lot of capital, it is also true that launching a business in this field can be very capital intensive, needing "a lot of equity to launch their business, although this varies depending on the type of activity and the strategy chose" (Rédis, 2010). So, it does not always result in an investment that anyone would be able to undertake.

Legal_form (SRL) impacts positively as it may be a safer corporate form in the eyes of lenders.

D_vp_competences impacts also positively; it is indisputable that having at least one entrepreneur with the skills consistent with the field in which the startup operates is as critical as it is important.

4.3.2. Approach 2

In this section, the second model is presented, with which the goal is to show that "scientificity", thus the independent study variable, positively impacts capital raising.

Again, the hypothesis argues that startups that use the scientific method, in this case represented by the variable "scientificity", to make decisions have a greater probability of obtaining funding from investors.

This statement is translated into the following model:

$$\ln\left(\frac{Prob(funding)}{1 - Prob(funding)}\right) = \beta_0 + \beta_1 scientificity + \gamma_i controls_i$$

Where:

- β_0 is the constant, which is the intercept term of the equation. It is the log-odds value of the dependent variable when all independent variables are zero;
- β_1 is the coefficient of the independent variable (scientificity) in the logistic regression model. It indicates the change in the log-odds of the dependent variable for one unit change in the independent variable, holding all other independent variables constant;
- γ_i are the regression coefficients associated with the control variables.

To get a more intuitive idea of the increase or decrease in the probability of obtaining financing, the following formula can be used. Within it one must enter the values of the regressors and variables of a startup. By going to vary the value of one variable at a time, one can see the effect, thus the increase or decrease in the probability of obtaining funding.

$$p(funding) = \frac{1}{1 + e^{-(\beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_N X_N)}}$$

And the result of logistic regression is shown in Table 23:

Logistic Regression Results 2						
				No. Observations:		89
Dep. Variable		funding (Y)		Df Residuals:		66
Model		Logit		Df Model:		22
Method		MLE		Pseudo R-squ.:		0.3745
				Log-Likelihood:		-37.565
				LL-Null:		-60.056
				LLR p-value:		0.002667
Variable	**coef**	**std err**	**z**	**P>|z|**	**[0.025**	**0.975]**
const	-7.7093	2.563	-3.009	0.003	-12.732	-2.687
scientificity (X2)	1.3757	0.436	3.157	0.002	0.522	2.23
n_team_members	0.6529	0.294	2.224	0.026	0.077	1.228
n_employees	0.1311	0.204	0.644	0.519	-0.268	0.53
d_bachelor	2.8999	1.768	1.641	0.101	-0.564	6.364
d_ms	-0.8407	1.028	-0.818	0.413	-2.855	1.173
d_ post lauream	-0.9777	0.935	-1.046	0.296	-2.81	0.854
d_phd	0.1777	0.897	0.198	0.843	-1.579	1.935
d_same_uni	-0.4964	0.859	-0.578	0.564	-2.181	1.188
d_same_firm	-0.8808	0.73	-1.207	0.228	-2.312	0.55
d_same_family	0.9716	1.232	0.789	0.43	-1.443	3.386
d_econ_startup_edu	0.8171	0.966	0.846	0.398	-1.077	2.711
d_tech_startup_edu	-0.5249	0.865	-0.607	0.544	-2.221	1.171
d_fin_exp	-1.2244	0.937	-1.306	0.192	-3.062	0.613
d_tech_exp	-0.6122	0.777	-0.788	0.431	-2.135	0.911
d_startup_serial	-0.4998	0.832	-0.601	0.548	-2.131	1.131
share_startup_female	-3.2234	1.403	-2.297	0.022	-5.974	-0.473
startup_age	-0.2112	0.188	-1.123	0.262	-0.58	0.157
d_services	2.3697	0.976	2.429	0.015	0.458	4.282
geography	-0.4685	0.842	-0.557	0.578	-2.118	1.181
industry (ICT)	-1.9366	0.966	-2.004	0.045	-3.831	-0.042
legal_form (SRL)	1.7634	0.954	1.849	0.065	-0.106	3.633
d_vp_competences	0.7817	0.93	0.84	0.401	-1.042	2.605

Table 23: Logistic Regression 2

Unlike the previous regression, the number of observations is 89, and not 107, because for several records the evaluations from rounds 2 to 5 of the interviews conducted were missing because the startups dropped out of the program before its end; therefore, having this missing data it was not possible to consider these records in the regression model.

The pseudo R-squared is higher and equal to 0.3745, indicating a good fit of the model.

The LLR p-value is less than 0.05, quite near to 0, meaning that there is a statistically significant difference between the full model and the null model, significantly improving the goodness of the model, leading us to reject the null hypothesis, according to which the observed difference (or a more extreme one) between the log-likelihoods of the two models is not due to the predictors included in the model. The goodness of this second model is, therefore, much better than the previous one.

Also in this regression the coefficient β_0 is negative.

In this model, the study variable "scientificity" has, like the "treatment_dummy" variable, a positive value, given that it positively affects the probability of obtaining external funding, but, unlike the previous variable, it also has a p-value of less than 0.05, but also less than 0.01; this implies that the probability that it is not statistically significant is less than 1%, so the hypothesis that it is statistically significant is very strong. This confirms the hypothesis that was intended to be demonstrated, namely, that scientific decision-making behavior helps startups in the process of obtaining funding.

As was done in the previous approach, it can be relevant to comment on the p-values and signs of the coefficients of the control variables as well.

The variables that have p-values with values less than 0.05, thus statistically significant, are n_team_members, share_startup_female, d_services and industry (ICT).

Again n_team_members has a positive coefficient, indicating a positive effect on the probability of obtaining funding, as discussed in the previous approach.

Share_startup_female, on the other hand, again has a negative coefficient, again indicating the gap that women face in this world too.

D_services, unlike the first approach, has a very low p-value and a value, and a positive coefficient, underscoring the positive effect that developing a startup in the services sector can have on raising funding, as previously discussed.

The industry (ICT) variable also has a p-value less than 0.05 and has, again, a negative coefficient, indicating the downsides of having an ICT related startup can lead to seeking capital.

N_employees again has a positive sign, as in the previous analysis, indicating a positive effect of this variable on the probability of obtaining funding.

The four variables inherent to educational backgrounds also have, respectively, the same signs as the related variables in the previous analysis, so while d_bachelor and d_phd have positive values,

consistent with the fact that startups with entrepreneurs who have higher degrees of education are more likely to obtain funding, d_ms and d_post_lauream have negative values.

D_same_uni, d_same_firm and d_same_family respectively have the same sign as the relative variables in the previous approach, consolidating the relative motivations already discussed.

The signs of the variables related to economic and technical education and financial and technical experience are also consistent with the previous ones.

D_startup_serial, on the other hand, unlike before, has a negative coefficient, which would go against many studies and evidence; but the p-value is very high, so it can be assumed with some level of confidence that this result is not statistically significant.

Startup_age again has a negative sign, indicating that startups that have not yet had funding and with a longer life will have more difficulty in raising financings.

Geography is again negative and with a value in absolute terms greater.

Legal_form (SRL) again has a positive impact.

D_vp_competences also has a positive impact on raising capital, as having at least one entrepreneur with the correct skills for the field in which the startup operates is critical.

5. Results

Thanks to the analysis conducted in the previous chapter, the following results were obtained.

The hypothesis could not be confirmed using the initial model (namely, the Randomized Controlled Trial model), which suggests that participating in the program and undergoing the scientific method treatment for decision making did not result in a significant advantage in raising funding.

The hypothesis, however, was confirmed by the second model, where the probability of securing funds was modulated according to the level of scientific rigor employed in the decision-making process. Consequently, firms that made decisions based on scientific principles were more inclined to raise capital.

The observed disparity between the two models might be attributed to the complex nature of scientific decision-making, which is influenced by various factors beyond mere exposure to experimental treatments. This observation is supported by the higher Pseudo R-squared value of the second approach compared to the first approach, as well as the lower LLR p-value. These findings indicate that the second model exhibits a stronger fit to the data and demonstrates a statistically significant ability to explain the variability observed in the dependent variable through its predictors. The sole distinction between the two models is in the study dependent variable. Consequently, the first model may have overlooked additional pertinent variables that could potentially impact the acquisition of funds, as they were not accessible from the project database. On the other hand, when considering scientificity as the independent variable, which refers to the extent to which startups make scientific decisions, the model is superior. This model takes into consideration not just whether the startups were exposed to the treatment but also other characteristics. While the model still has a reasonably high Pseudo R-squared, it is not assumed that all significant variables were included. However, it is evident that the variable "scientificity" is more comprehensive than the variable "treatment_dummy" alone.

Ultimately, to answer the research question, it is possible to demonstrate the thesis of this paper, namely, that startups that apply the scientific method in decision making are more likely to attract fundings.

6. Conclusions

6.1. Main findings and implications

The objective of this thesis was to ascertain whether employing the scientific method, in contrast to heuristic approaches, could provide a net advantage in terms of raising capital, a crucial aspect of startup development.

This study started from what has been demonstrated by other scholars, thus the different benefits that applying the scientific method has for startup development, compared to using heuristic methods.

This led to the formulation of the research question: "Are startups that use the scientific method in decision making more likely to get funding?".

The answer to the research question argues that the utilization of this approach enhances the probability of obtaining financial support. Furthermore, it is crucial to consider other significant elements, such as the entrepreneurial team or the sector in which the company operates. However, the literature suggests that numerous other aspects are also significant.

This study has the potential to provide significant benefits to entrepreneurs by demonstrating that the utilization of this particular method, in contrast to alternative approaches, can greatly enhance the success of their starting businesses. Furthermore, it can also benefit the investors themselves by enhancing their comprehension of the attributes of a scientific decision-making approach, so enabling them to invest in startups with a higher probability of survival and success.

6.2. Limitations

Despite the important findings, it is imperative to acknowledge that this study has certain limitations.

These limitations mainly relate to the type of sample used in the experiment, the sample size, the duration of the experiment itself and the variables collected.

Almost all of the startups (with the exception of one) are startups that are part of the Italian ecosystem, and so are most of the entrepreneurs who are part of it. This suggests that elements that hold significance within this particular context may not hold significance in different nations.

Randomised Controlled Trials (RCTs) are often associated with a limited degree of "generalizability". Furthermore, this methodology presents additional challenges due to the inherent difficulty of conducting studies over a longer period of time. Additional challenges include the acquisition of large study samples and ensuring the sustained participation of startups throughout the duration of the project, instead of premature exit.

The current sample size, consisting of startups, is sufficient, but in order to enhance the accuracy of the regressions, it would be beneficial to have a larger sample. Nevertheless, due to the nature of the subject of the study, being startups rather than easily observable and collectable entities, obtaining and managing a very large sample may be challenging.

The duration of the experiment may, as expected, also impact the study. Startups that failed to raise funding during the post-training phase and prior to the interview may have subsequently acquired them.

The study may have been influenced by the nature of the variables that were collected as well, since other variables that have not been collected could significantly impact the effectiveness of fundraising efforts.

6.3. Further developments

This presents an opportunity for future research endeavors to be conducted in different countries, with the aim of understanding if there is a substantial variations among countries. To expand the sample size, the initiative might be replicated to include more startups that are in a comparable stage of development to those included in the study. The experiment's lifetime could be extended, to see whether startups succeed in obtaining funding, surviving and achieving success. Ultimately, the acquisition of a more extensive and comprehensive dataset encompassing relevant variables can contribute to the development of more robust models.

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